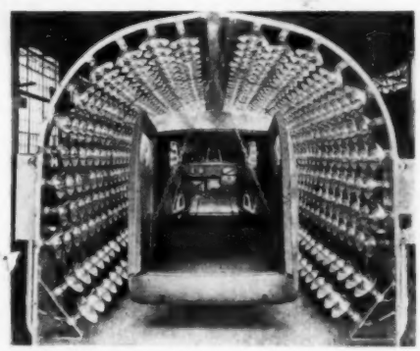
AMERICAN MACHINIST

October 2, 1940



Hot Lamps—*Industry turns to the red end of the spectrum to speed the drying of metal finishes*

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A New Service

FOR YOU IN

The Metal Show Number

★

• The current defense program, piled on top of normal heavy business, has forced many metal-working companies to seek outside help in producing tools and dies, forgings, castings, stampings, etc., as well as for contract machining, heat-treating, welding and finishing. American Machinist is now compiling a detailed list of companies with specialized facilities for handling contract work. This, the first such directory to be published, will appear in October 16 Metal Show Number, as

A DIRECTORY OF CONTRACT-WORK FACILITIES

★

Watch for your copy—it will save you time and trouble.

WHAT'S IN THIS ISSUE

IN THE RED

Science has long known that wavelengths longer than those visible to the eye constituted radiant energy which, on being absorbed by a solid, was transformed into heat. It remained for the electrical industry to utilize this principle in the familiar "radiant" household heaters, and for therapeutics to apply it to the alleviation of certain bodily disorders.

For infra-red rays are persistent—they'll penetrate into a translucent body much farther than visible light. Thus when they are finally dissipated their energy is released, in the form of heat, considerably below the surface. Medicine finds this phenomenon useful in producing subsurface heat in human tissue without causing excessive skin temperatures. And it is this same characteristic that makes these rays ideal for drying many metal finishes—"from the inside out."

Like other new developments, most infra-red baking installations must be tailored to each individual job. Also like most innovations, the process has become surrounded with superstitions and misconceptions which it doesn't deserve. Hence our enthusiasm for the article beginning on page 741, which gives the latest details of infra-red baking technique and explains what it can and can't accomplish. It's written by John Sasso, associate editor of *Product Engineering*, who has spent some six months assembling data for the story. He figures if you consulted all the sources he did you'd spend 368 hours and $8.75 on cigars. For the first installment of the results of his labors, turn the page.

E. GEORGE MARSHALL

. . . never too small, never too busy

IN REVERSE

Is a shop ever too small or too busy for a comprehensive apprentice training program? Rarely, says E. G. Marshall, assistant superintendent for Pittsburgh Screw & Bolt Company. It's Mr. Marshall's idea that in planning a course you should do it in reverse—a rather unusual approach, we'll admit. But if you're working on an apprentice course for a small shop you'll get some good ideas from page 745.

TOO HOT?

Heat has long been the enemy of efficient lubrication. Though modern research has developed oils which stand up under temperatures undreamed of a few years ago, there are still many high-temperature lubrication jobs where oil is out of the question. It is in such cases that graphite really comes into its own. It can be suspended in several different kinds of carriers which burn off fast or slow, clean or otherwise. There probably is a combination which is just right for that tough hot lubrication job that may have you worried. On page 747 are some examples of the ways graphite helped others.

FINALE

Though this issue contains the last installment of C. C. Street's series on measurement, we feel the last part is one of the best. Certainly it's one of the most timely, as it deals with gages for various types of internal bore measurements. As in Mr. Street's previous discussions, both theoretical and practical aspects of the problem are analyzed, beginning on page 748.

DEFENSE

From the daily papers anyone would get the idea the United States' only defenses consist of wooden machine guns, stove-pipe howitzers and trucks labeled tanks. Such, we submit, is not exactly the case. The U. S. knows the meaning of mechanization and motorization as well as any country. The fact that developments have not parallelled those in Europe is due largely to vastly different combat conditions which would prevail in America. If you'd like accurate and authoritative information on what these developments have been, read Major Robert Ginsburgh's article beginning

Harris & Ewing

MAJOR ROBERT GINSBURGH

. . . outlines U.S. defense progress

on page 755 of the AMERICAN MACHINIST Armament Section. In it Major Ginsburgh analyzes fundamental problems of army mechanization, outlines various approaches to their solution, and reports on progress.

JUST IN CASE

Following Major Ginsburgh's discussion, and making up the balance of the Armament Section, is another how-to-do-it article—this time telling how to make artillery cartridge cases. By Frank J. Ferro, foreman in the artillery cartridge shop at Frankford Arsenal, it describes in detail the operations and tooling required to produce these essential items. Since cartridge cases of this type will be needed in huge quantities should the U. S. become embroiled in another major war, we respectfully recommend Mr. Ferro's article to all who conceivably could help in their production. You'll find it on page 760.

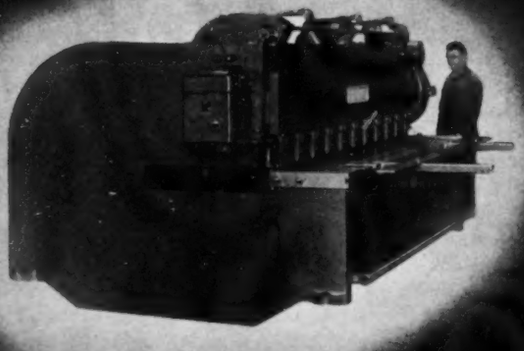
COMING

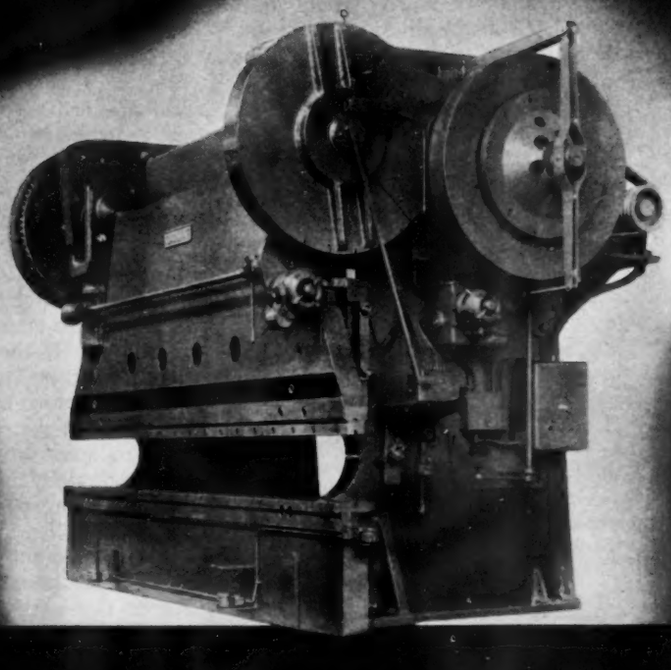
You won't want to miss our next number. To be devoted entirely to the National Metal Congress & Exposition in Cleveland, it will contain a preview of new equipment on display, a complete list of exhibitors, and many other helpful features. A special section will reveal the parts that welding and heat-treating play in the national defense program. Still another special section will give exhaustive data on the working of carbon sheet steel. All this in the October 16 AMERICAN MACHINIST.

ARMOR PLATE

. . . Shear it on Cincinnati Shears
. . . Straighten it on Cincinnati Brakes

Write for recommendations based on our twenty years' experience in building Cincinnati Steel Press Brakes and Cincinnati All-Steel Shears for arsenals, navy yards, and manufacturers of armament.

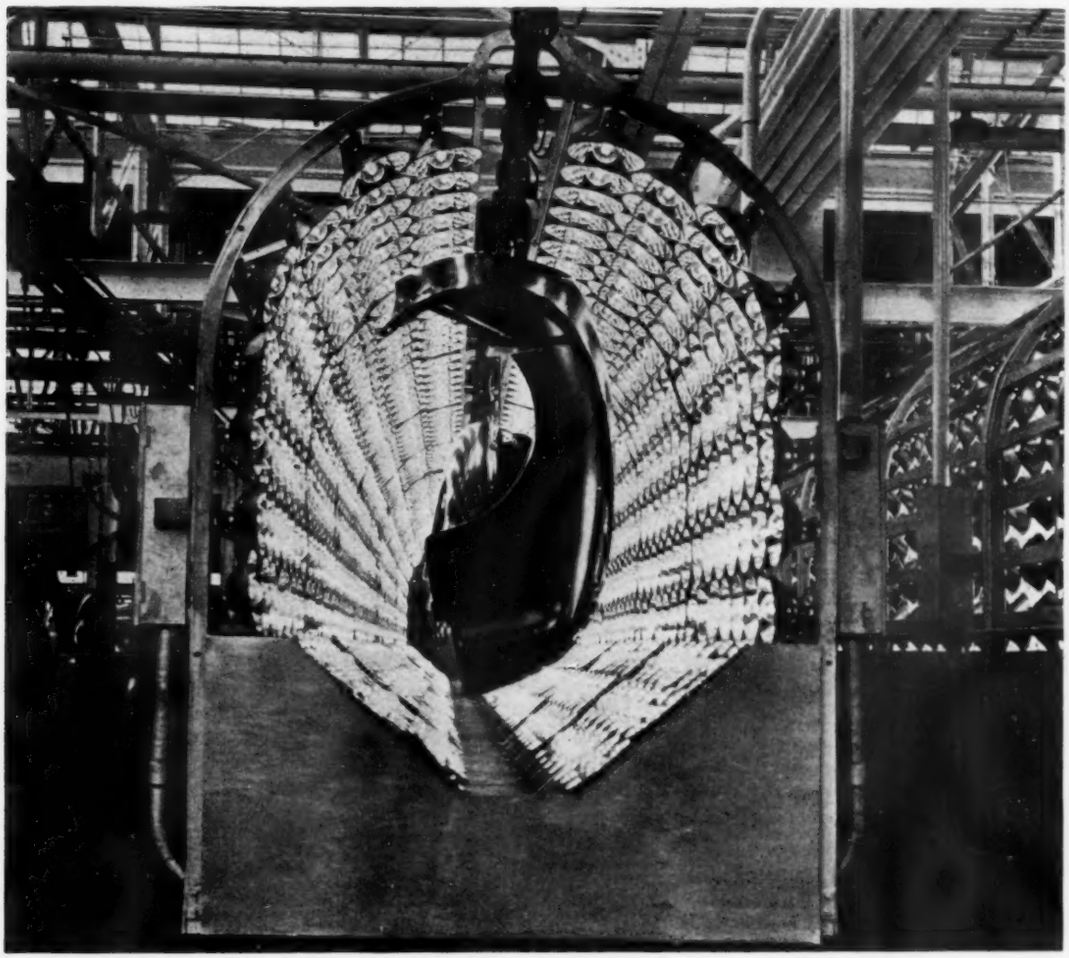




THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

SHAPERS · SHEARS · BRAKES

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor



Ford fender finish is quickly dried by passing the parts through a lamp-lined tunnel

Infra-red in industry

BY JOHN SASSO

Radiant heat from the sun keeps this planet habitable. The same phenomena finds new application on metal products

RADIANT ENERGY, produced by short wave lengths in the infra-red range of the spectrum, was applied a few years ago by the Ford Motor Company to the drying of automobile body finishes. Since then electrical infra-red drying has attained considerable acceptance; it is now being used for drying prime and finishing coats on auto bodies, enamel on parts such as steering columns, lacquered surfaces, paint on castings, enamels on die-castings, for softening plastic sheets prior to punching and for baking transformers and armatures.

Advantage has been taken of radiant heat in conventional gas-fired baking ovens for years. However, in the last few years, new electric and gas infra-red heat sources have been developed. Widespread attention has been given electrical sources of this energy because of the high color temperature and efficiencies obtained with incandescent lamps, and because the baking set-up is simple, even though it is sometimes difficult to place the full surface of the part being dried in front of the rays. In complicated assemblies, having shadows and inaccessible surfaces, con-

vection oven baking is usually the solution. But some finishes cannot be successfully dried by convection, and conduction must be used.

In non-technical terms infra-red red energy is similar to what we know as light, except that infra-red is longer in wave-length than visible energy. The fundamental principles parallel those of lighting. However, sources of radiant energy operate at a lower temperature than those used for light.

Another difference lies in the amount of energy required; in radiant heating, densities on a surface may run as high as 1,000 watts per sq. ft.; the same surface would be brilliantly illuminated with 50 watts per sq. ft. In the radiant spectrum, wave-lengths are in that portion overlapping light wave lengths and extend from 0.6 to 0.7 millionths of a meter to five millionths of a meter. Commercial sources of radiant energy emitting most of their energy in the wave-length of one-millionth of a meter operate at 2,500 F. By lowering the temperature of the source, the wave-length is increased.

Incandescent bulbs arranged in various ways, Fig. 1, furnish the source of energy for infra-red drying. Both tungsten and carbon filament lamps are used. Originally the standard lamp was 240–260 watts; recently tungsten lamps of higher capacity, 500 and 1,000 watts, have been announced for this process. See Table I. Maximum energy distribution of these lamps occurs at about 2,500 deg. absolute, with wave-lengths of about 11,000 to 14,000 angstrom units (0.0000011 to 0.0000014 meters long) depending on the type.

Of the electrical energy input into these lamps, approximately 90 per cent is converted into heat waves which penetrate the surface and are reconverted into heat energy. The reduced baking time thus obtained is not caused by catalytic action but by the attainment of a higher temperature in a short time. This has been confirmed by tests made by the Glidden Company and the Pontiac Paint and Varnish Company. Their conclusions were that an ordinary baking oven, operating under temperatures available from radiant energy, would produce the same results in the same time. It follows that radiant drying is merely an effective method of getting heat into a paint film in a minimum of time.

The surface with the highest reflection factor for infra-red energy is gold plating; copper and silver plating are close to gold; Alzak is also well suited for redirecting the near infra-red energy. Other materials, such as chromium and aluminum, are less efficient; silver and copper tarnish quickly. Gold-plated reflectors are more stable than silver, but they should be cleaned every six weeks when drying lacquer. Efficient reflectors redirect the radiant energy so thoroughly that there is no sensation

TABLE I—AVERAGE WATT PER SQ. IN. ON WORK

	*Triangular banking of units **	*Rectangular banking of units **
250-watt drying lamps in 12 in. gold-plated reflectors; edges touching; 12 in. from work	1.2	1.1
250-watt drying lamp in 9 in. gold-plated reflectors; edges touching; 12 in. from work	1.8	1.5
250-watt drying lamps in 8 in. gold-plated reflectors; edges touching; 12 in. from work	2.0	1.7
500-watt drying lamps in 12 in. gold-plated reflectors; edges touching; 12 in. from work	2.5	2.2
1000-watt drying lamps in 12 in. gold-plated reflectors; edges touching; 12 in. from work	5.0	4.4
Sunlight; summer at noon; sea level.....	0.7	

* See Fig. 1.

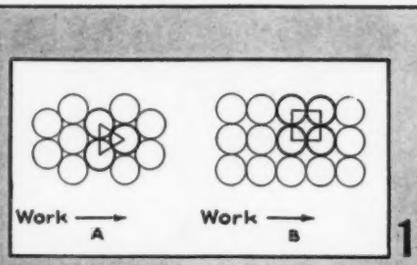


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Fig. 1—Of these two ways of arranging light units, Method A gives fifteen per cent greater concentration and better energy distribution than Method B

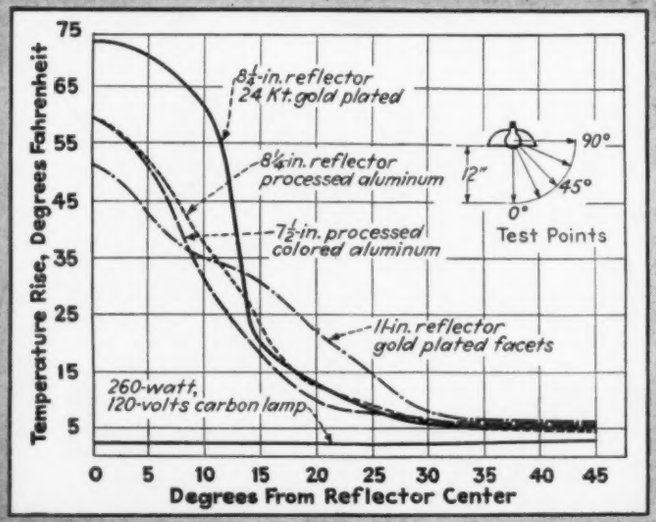

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Fig. 2—Size and material of the reflector have a marked influence on the effectiveness of the heat source, as shown by these curves

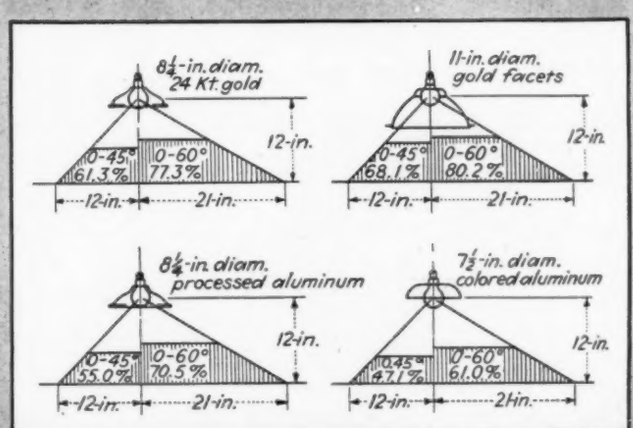

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Fig. 3—The type of reflecting surface and the angle of cut-off determine the per cent of total radiation delivered to the working plane according to actual test

TABLE II — REFLECTION FACTORS OF PIGMENTS

PIGMENT	Wave-length (Angstroms) 6,000	9,500	44,000
Cobaltic oxide—steel gray	3	4	14
Chromic oxide—dark green	27	45	33
Lead oxide — yellow	52	—	51
Ferric oxide — red	26	41	30
Lead chromate—yellow	70	—	41
Zinc oxide — white	82	86	8
Lead carbonate —white	88	93	29

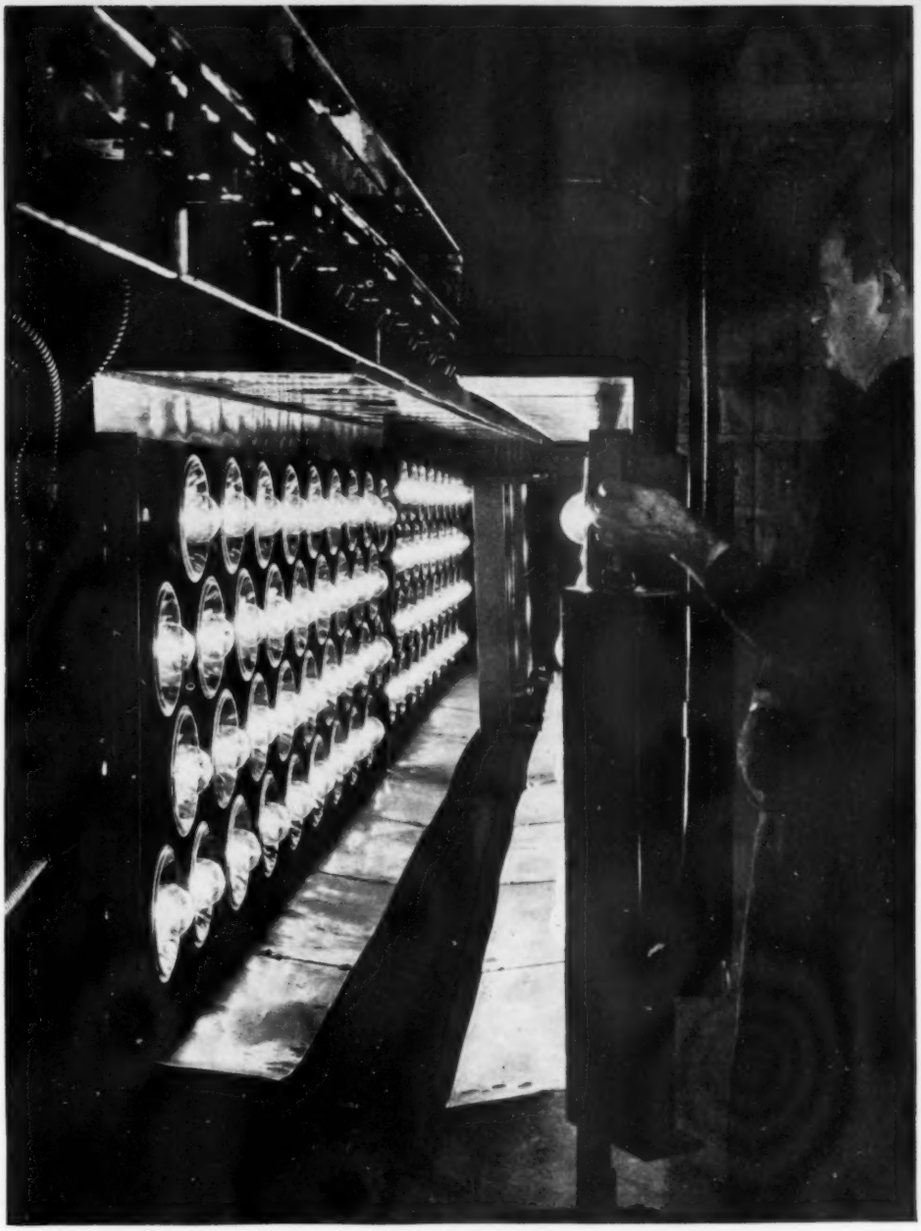
of heat near the reflectors, even when they are operated in groups of hundreds.

Tests indicate that a concentration of six watts per sq.in. on 20-gage black painted sheet steel will give a temperature of 500 F. in five minutes while a concentration of two watts per sq.in. will give a temperature of only 220 F. in the same time. Concentration of energy depends on the wattage of the lamps, as well as the design and spacing of the reflectors.

The amount of heat at the surface of the part varies inversely as the square of the distance to the lamp. In commercial practice this distance is only 6 to 18 in., depending on the time the pieces stay under the lamp. The design of the reflector is much more important than is the distance from lamp to surface.

Tests conducted in the lighting laboratory of Commonwealth Edison on infra-red reflectors indicate that reflector diameter is a factor in determining radiation density; the solid angle subtended by a reflector is a factor with regard to glare and to percentage of lamp energy redirected to the working plane. With a reflector which has a cut-off below the filament center, glare in the eyes of adjacent operators is prevented to a considerable extent.

From Fig. 1, it might be concluded that the 8¼-in. and the 11-in. gold-plated reflectors were about on a par, but reference to Fig. 2 shows that the total radiant energy delivered on the work by the 11-in. reflector exceeds that given by the 8¼-in. unit. For any given lamp, the total radiant energy delivered on the work may be greater for a smaller-diameter reflector even though that reflector individually has the lower efficiency. Thus, with the 11-in. reflector made up into banks, the spacing ordinarily would be 12x12 in., or 144 sq.in. per 260 watts, whereas the 8¼-in. reflector ordinarily would be mounted on 8½x8½-in. centers, corresponding to 72 sq. in. per 260 watts.



The Steel Storage File Company uses a baking schedule under five minutes for polymerin finish with this radiant infra-red installation

Higher reflection factors of the surface do not remain constant but change with the wave-length of the infra-red; this variation is indicated for some pigments in Table II.

Reflection factor, or ability to absorb energy, depends on the pigments and color. Hence white and other light colored finishes cause more difficulty in getting the rapid baking desired for good production. In one application where a high reflection factor was encountered, the reverse side of the metal was heated, drying the paint by conduction, as the bare steel effectively absorbed enough of the available energy to dry the finish.

Red colors, next to white, are the most difficult to dry because of their generally high reflection factor in the infra-red range. Blues and greens are good in absorbing radiation.

Various colors on thin gage steel sheets have been tested. White paint reached a temperature of 315 F. in eight minutes while red, yellow and gray reached successively higher temperatures up to black which reached 460 F. also in about eight minutes. Aluminum paint reached only 250 F. in the same time interval.

Large mass with a limited surface presented to the rays will conduct heat away from the surface and retard drying. This effect is useful when baking cores or motor armatures.

black indicate that thickness has an appreciable effect on the "heating-up" time. In four minutes a 14-gage panel reached a temperature of about 230 F. while a 20-gage panel, only about half as thick, reached a temperature of about 260 F. in the same time. In eight minutes the temperatures were 300 to 325 F., respectively. If baking time is long enough, the work is heated through, and from then on its thickness has no further effect. With finishes which have a short baking time, the thickness has a definite effect on the production rate since a large percentage of the total time is consumed in bringing heavier gages up to temperature.

Other factors which affect the rate of drying are: the specific heat and conductivity of the material; heat losses from low temperature radiation by the work; air currents or drafts; conduction to backing or supporting members; area presented as a "target" for the rays; film thickness and type of finish.

While the cooling effect of drafts should be kept to a minimum a certain amount of air movement is required to keep the volatiles from reaching inflammable concentrations. With proper technique there is no danger of explosion.

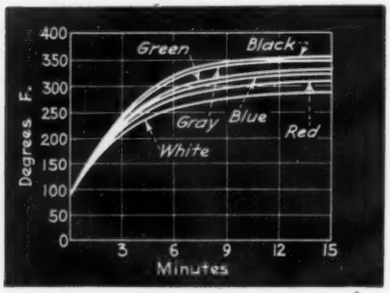


Fig. 4—The temperature reached during drying time varies with the color of the paint; these readings were on 22-gage sheet steel

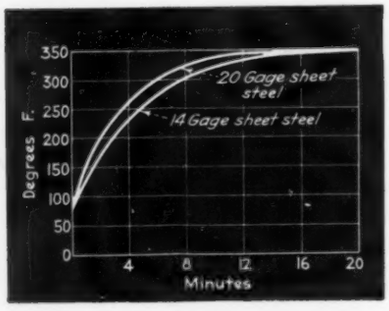


Fig. 5—The temperature is also affected by the thickness of the panel on which paint is applied; note the more rapid rise for the lighter material

TABLE III—HARDENING CHARACTERISTICS OF FINISHES

Material	*Baking Temperature*	*Comment*
Synthetic enamels; alkyd synthetic and urea-formaldehyde modified synthetics	250–350 F. (1.75–2.0 watts per sq.in.) 350–400 F. (about 2.8 watts per sq. in.)	Harden by polymerization and/or oxidation. Oil modified resin is used instead of an oil as the vehicle. Response to infra-red treatment depends on pigments and color.
Lacquers	100–150 F.	Harden by evaporation. Since they are dried at low temperature to avoid pinholing and budding no discoloration will occur. Formerly air dried because of the low temperatures, use of infra-red has proven a great time saver.
Wrinkle finishes	150–450 F.	More difficult to bake out because of the high temperatures required and longer time required for oxidation.
Japans	———	Baking japans have not proven economically feasible for this method of drying as the vegetable oils which they contain harden too slowly. Air-drying japans, however, offer no difficulty.

For parts having large surfaces it is necessary to present as much as possible of the total area to the energy source by proper lamp or conveyor arrangement. Parts with recesses may cause difficulty because they heat unevenly or because the radiant energy does not reach all the areas to be dried. Unusual or difficult applications of this sort must be solved by trial installation. In an electric auto parts plant, it was found that by rotating parts of irregular area under the lamps, synthetic enamels were dried satisfactorily in 10-15 min. instead of the 60 min. required by gas oven.

Air-dry finishes may be handled by infra-red drying at temperatures not exceeding 150 F. House paints and architectural finishes made with oleo-resinous vehicles do not behave satisfactorily with infra-red. Synthetic enamels and wrinkle finishes require higher temperatures but cause no particular difficulty. Temperatures as high as 600 F. have been satisfactory for baking wheel finishes. All synthetic enamels do not respond to infra-red drying to the same degree, as some tend to "yellow" because of the actinic property of the light.

Discoloration may occur if the temperature under the lamp is allowed to exceed the baking temperatures. Most of the organic pigments are sufficiently stable to be heated successfully, if careful control of temperature is exercised. Some finishers have found that the substitution of inorganic substances for organic pigments solves the problem of control.

Insofar as the other constituents of enamels are concerned, some of the resins in the finish may cause no particular trouble. See Table III. Speed of baking depends somewhat on the oils introduced to modify the resins; perilla and tung oil have been found to be satisfactory. Soya oil vehicles dry too slowly for the infra-red method.

Experiments in drying oil-base paints, similar to house paints were unsuccessful when application to farm equipment and to wooden toys was attempted. Oil paints and oleo-resinous materials in general cannot be baked rapidly enough under infra-red lamps because they require considerable oxidation.

A second article on "Infra-Red in Industry" will appear in an early number.

The Microscope as a Shop Tool—Correction

JOSEPH DAUBER, author of the recently published article, "The Microscope as a Shop Tool," has called to our attention two minor corrections. The sentence starting on line 15, column 1 (*AM*—Vol. 84, page 530) should read "In this case each numbered division of the scale is equal to 0.010 in. on the object, and the range of measure is 0.1 in. Each of these intervals on the reticle has ten subdivisions, which are not shown in the illustration."

Also, on page 532, the sentence starting on line 4, column 3 should read: "This 60-deg. reticle may be either spider threads, or lines engraved on a glass plate, at 60 deg. to each other."

Training in the small shop

BY E. G. MARSHALL, ASSISTANT SUPERINTENDENT, PITTSBURGH SCREW & BOLT COMPANY

Rarely is a shop too small or too busy for apprentices. If properly taught, boys can pay their way from the very start

IN PLANNING a training program, first let us study the finished product, the first-class skilled mechanic, before we decide how to teach a beginner. When we build a die or machine we design the finished product, break it into small elements, then build it step by step. We should do the same with our skilled mechanics.

A skilled mechanic should know how to operate and care for most of the machines used by the trade. He should have a broad knowledge of bench work. He should be able to plan a new job so that each step will be done in proper sequence, in the least possible time, without wasted material or motion, with all work done accurately and neatly.

When a man is promoted, he is advanced because of ability to get results more than for any other reason. So let us agree that the basic cause for advancement is "getting results." Also let us agree that what we want to teach beginners is how to get results. Then where we shall get our boys? We must bear in mind that only those who are naturally gifted as mechanics are to be selected. I do not believe we should consider boys below the age of 18 or 19. Competition between mechanics is such that a boy without a high school education will be left behind. From the master mechanic's viewpoint, the boy with an academic high school education lacks two essentials to starting an apprentice course. He lacks the practical training of the trade school boy and the theoretical training of the college boy.

The boy who has had a college training has shown that he has a good degree of intelligence. Also in the engineering courses he has had a varied amount of shop work. Training in the theory of mechanics makes him a better prospect for the machine shop than the high school boy. When he starts in the shop, the theoretical training does not help him to get results at first. But after he acquires some practical ability the theory helps him to advance faster. His training in college shops is different from what he would get in industry. The boy who has been to a private trade school or has had machine shop training in the high school has the practical, but not the theoretical start to be an apprentice.

There is no guarantee that the boy will succeed. A trade is a guarantee only so far as receiving first-class mechanics' wages. A man can marry and have a family and be respected in his community as a mechanic. And using a mechanic's status as a base he can study and advance into other jobs. During depressions when overhead is being cut he can go back to work as a mechanic.

Now that we have decided what the finished mechanic shall be, and what boy to select for training, let us determine what the training program shall be. Let us remember that we are dealing with human lives, and that we may be the means of making many boys into failures or successes. Let us not use the apprentice system as a means of getting a supply of cheap labor. When we give our word to teach a boy a trade let us do it, and do it well. Another thing to avoid is training the boy in only the work he has to do at the moment, with the hope he will not be able to get a better job anywhere else. Limited instruction is apt to be reflected in spoiled work and worn machinery. Shops which train boys far beyond their daily needs will get more intelligent service, much better work and considerably longer equipment life.

For an apprentice course to be successful, everyone—manager, foreman and apprentice—must have confidence in each other and faith in the course

For an apprentice course to be successful, everyone—manager, foreman, and apprentice—must have confidence in each other and have faith in the course. The question of which benefits most from an apprenticeship—employer or apprentice—depends on whether the labor received from the apprentice equals the training value he receives from his employer. The rate of pay should depend on the same exchange of value.

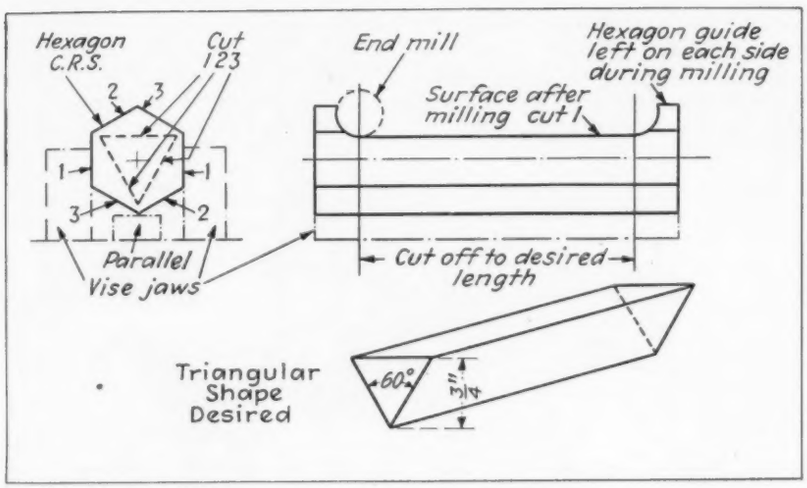
Shops which manufacture a single product, where necessarily the work is specialized, could trade boys with

other shops having a different class of work. As we expect the finished mechanic to think for himself and to have good judgment, he should be taught why as well as how all through his training.

In small shops that cannot afford a regular instructor, or where the number of boys will not justify the expense, the bulk of the training falls on the foreman. If he studies his boys attentively, and plans his own work carefully, he can get production from the boys almost immediately. The work can be arranged according to the skill required. The steps can be graduated to require very little training between successive steps. It is even possible to have the steps so close together that a few minutes of instruction every now and then will prove enough.

I have in mind a shop off the beaten path of floating mechanics. Older mechanics were suitable machinists, but they had no precision toolmaking experience. After trying to retrain machinists into toolmakers, it was found better to have an extensive apprentice course. The boys were trained in care and precision from the beginning. By insisting on high school graduates, the average caliber of the shop was raised. The work was done better and cheaper than before the apprentice system was started. Whenever a vacancy occurred a beginner was hired and several of the boys moved up a step. This caused a small amount of training for perhaps six boys, but not all the training for one boy. The almost constant promotion and raises kept the boys contented.

The course was so successful that employees in the methods department and assistant foremen have been recruited from the machine shop. A background of mechanics will help any foreman, even though he is not in the machine department.



How to get triangular stock in a hurry was solved by an apprentice with a flair for trigonometry

"Sines and Cosines"

BY GEORGE BUSMAC

BILL WAS AN apprentice machinist by day, and a student of "math." by night. At the time I discovered this he had been dubbed "Sines and Cosines" by his fellow workers. Anxious to find the reason for the name I watched Bill and found that from the way he handled sines and cosines in his *trigger*nometry, he certainly was the best shot in the outfit.

I did my best to convince Bill that trig did not help much on the lathe, miller and shaper and much less when babbitting hanger bearings. But Bill was determined to carry on his study of sines and cosines.

One day the Chief wanted a triangular piece (as per sketch) for a new model, and as usual wanted it P.D.Q. I surveyed all my millers with indexing equipment, and all of them were in the middle of jobs which could not be stopped without spoiling the parts being worked. All that was left was an old hand miller with a vise with 4-in. jaws (no index equipment available). I called Bill, and giving him a piece of square C.R.S., told him to mill the other two sides to make the triangle. I allowed him one hour to produce the part and then left him to his own resources.

In slightly over half an hour, much to my astonishment, Bill laid the finished triangular piece, milled on all three sides, upon my desk; at the same time he gave me back the square piece of steel.

Trying hard to conceal my surprise I asked for an explanation. Bill answered, "Sines and cosines gave me an idea." He used a piece of hexagon stock, and holding it in the vise as shown, milled one side, then turning the hex. as numbered, he cut the second side and so on for the third side which completed the triangle. Then he cut off guide ends to make a piece of the required length.

Since then, I have encouraged apprentices, and hard boiled machinists as well, to study sines and cosines.

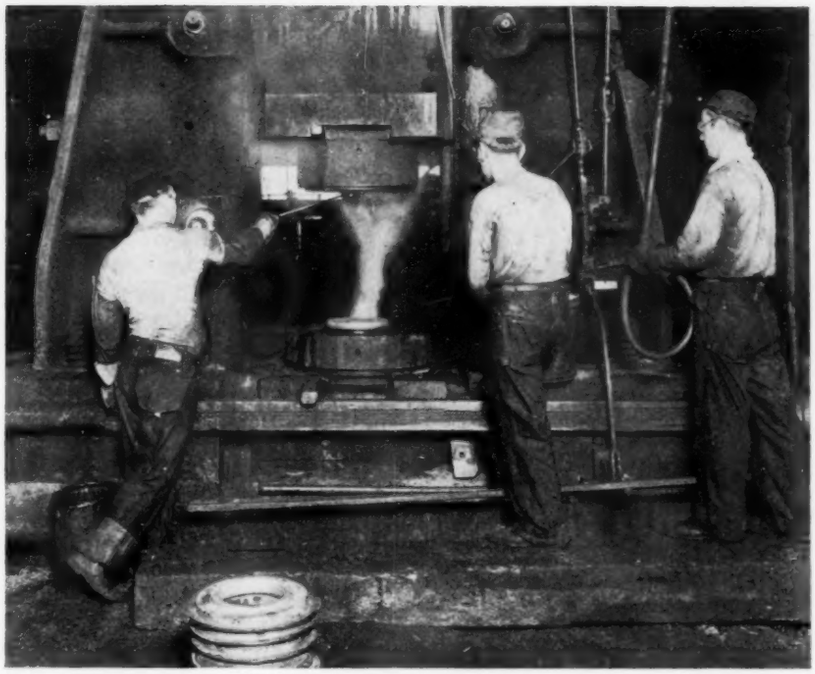
Race for Safety

SEABISCUIT races across the bulletin boards of the All-Steel Equip Company with every foot of the way hotly contested by an as yet unnamed dark horse. Each represents one of two teams of employees trying for the two monthly prizes given to the team with the best safety record. Employees are members of the "odds" or "evens" team depending on their clock numbers.

The "Safety Steeplechase" is a recent innovation to give added zest to a safety prize contest which this plant holds every month. It provides a graphic way of announcing team positions every day.

Scores depend on accidents which require doctor's care. For the first call 25 points are marked against the individual's team. Each additional call counts 2 points. At the end of the month the team with the lowest score is eligible for prizes. Lots are drawn to determine who on the winning team are to receive the two prizes. Those who have had points chalked against them for accidents are ineligible. If any one month's contest ends in a tie, the prizes are held over for the succeeding month's winners.

Value of the prizes varies from $10 to $15. Prizes never consist of cash. Instead they are always articles useful in the home or important to the employee. Thus the family as a unit has an interest in the contest and additional emphasis is given to the entire safety program.



Drop hammer die life is increased and forging quality improved by swabbing the die with oil containing colloidal graphite prior to each blow

Too hot for oil?

Just because moving parts are too hot to oil is no excuse for improper lubrication. A suspension of graphite often solves many problems at once

CONVEYORS for heat-treating ovens, lithographing ovens, enameling ovens, paint drying ovens, and other high-temperature applications demand a lubricant which will not flash off or carbonize at the temperatures encountered. One solution for this problem is the use of colloidal graphite suspended in a carrier best suited to the particular conditions involved. This carrier may be oil, naphtha, kerosene, carbon tetrachloride, or some other fluid.

Generally, the fluids or carriers are intended merely as a means to get the graphite to the desired bearing surfaces. Their selection will depend on the amount of penetration required, the speed with which they burn off, which affects penetration, and their flash point. Wherever high temperatures exist, experiment may be required to determine the amount of graphite to be included in the fluid carrier. In lithographing ovens, volatile organic fluids such as naphtha have been used as fluid mediums, because they flash off without leaving deposits. They are also used on assembly lines in auto plants and on paint conveyors in farm equipment plants because of their cleanliness.

While more graphite generally is used as the temperature and pressure increase, there are applications where the reverse is true. Some railways and railway equipment manufacturers have found that a small amount of graphite is most suitable for fire-box studs and superheater assembly.

In high-temperature fittings such as used in refineries and other processing plants where return bends and other joints have to be dismantled frequently, oil with colloidal graphite is used on bolt threads to avoid seizure and galling.

A chain-driven plate-type conveyor for carrying spark-plug insulators through a kiln was difficult to lubricate because the high temperatures caused ordinary lubricants to burn off, carbonize and flake. Two automatic lubricators of the air-operated spray type, were used to spray colloidal graphite suspended in carbon tetrachloride directly on the lower bearing surfaces. The carbon tetrachloride evaporates almost instantaneously because the conveyor has a temperature of 375 to 400 F. at this point, leaving a coating of dry graphite on the wearing surfaces. A small amount of kerosene and oil added to the solution slows up evaporation slightly and permits the graphite to completely cover and lubricate the bearing surfaces. It has been found unnecessary to use the lubricator all the time, as sufficient graphite adheres to give satisfactory 24-hour lubrication with only a short period of operation once a day.

There are special solutions of oil and colloidal graphite which are being used at temperatures as high as 1,600 to 2,000 F. Generally the main problem is to get a carrier which will get the graphite to the desired location before carbonizing.

Another point in the use of graphite as a lubricant in ovens is that acid fumes such as may exist in a bonderizing oven have no effect, while in lithographing ovens the varnish formed on the inside of the oven by the volatiles will not adhere to the graphited surface.

Several large forging shops are using lubricants as a vehicle for colloidal graphite. The lubricant acts only as a carrier because at the temperatures at which iron or steel is forged any lubricant burns off. It is in this very fact that differences in die lubricant vehicles occur. Whether a low or high viscosity vehicle should be used is a matter of some argument. It is contended that a higher viscosity material will make for slower burning with consequent less flash. Some automobile manufacturers now require exceptionally close tolerances in their forged parts. It is particularly important in this kind of work that the metal must not stick, which means that the oil vehicle must leave the die clean so that there is no build-up of materials to spoil the contour of the die. To avoid gummy deposits high-grade mineral oils, such as "bright" stock, are generally used as the vehicle.

With reference to the use of higher or lower viscosity materials it is possible in the simple and shallow dies to use lower cost, lower viscosity materials because the flash point is not as important as it might be in the deeper, more complicated dies. The graphitic content is about the same in both cases.

Indicating bore gages

BY C. C. STREET, CHIEF ENGINEER, FEDERAL PRODUCTS CORPORATION

Simple methods for testing the accuracy of indicating bore gages are given in this final installment of a series on common measuring devices

ONE OF THE most important divisions of the art of precision measurement is the gaging of cylindrical bores. Here, limitations are set up because the fixture or device usually must be contained within the confines of the bore itself. The limited space available often controls the possible design and principles applied. Thus, it differs considerably from external gaging where, figuratively speaking, it is possible to control the alignment and relationship of the various locating devices without too much difficulty and, usually, as much room as needed can be taken up by the mechanism of the measuring instrument.

Since in measuring cylindrical bores the space available is limited, the fundamental types of misalignment must be considered carefully. The true diameter of the bore is the dimension usually desired. Evaluation of this diameter is subject to basic types of errors. First of these is the deviation of the measuring plane from the axis of the bore. By examining Fig. 13 it can be seen that:

$$D_1 = 2\sqrt{r^2 - a^2}$$

where D_1 represents the measured diameter, r the actual radius of the bore and a the displacement of the planes. This equation shows that for small values of a, D_1 does not differ materially from true diameter D of the bore.

Again referring to Fig. 13, it is obvious that:

$$D_1 = 2\,r\,cos.\,\alpha$$

and therefore the rate of change of D_1 is small for small values of α since the cosine remains equal to unity to three significant figures up to an angle of approximately $2\frac{1}{2}$ deg.

The second source of error exists when the measurement is made in such a manner that the angular relationship between the diameter measured and the axis of the bore varies from a true perpendicular condition. This can be seen by referring to Fig. 14. Where D represents the true diameter, D_1 represents the diameter indicated by the gage, and b represents the displacement longitudinally in the bore of one of the measuring points, we have a relationship in which:

$$D_1 = \sqrt{D^2 + b^2}$$

This might also be expressed by using β. Here,

$$D_1 = \frac{D}{cos.\,\beta}$$

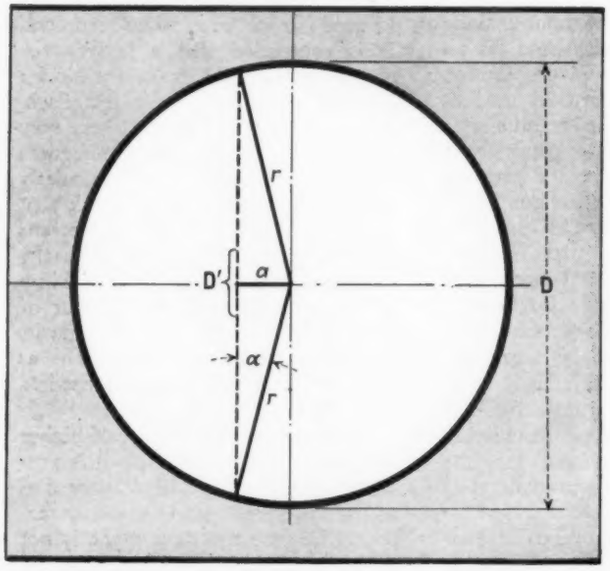


Fig. 13—Deviation of the measuring plane from the axis of the bore is one of the basic types of errors to be considered in bore measuring instruments

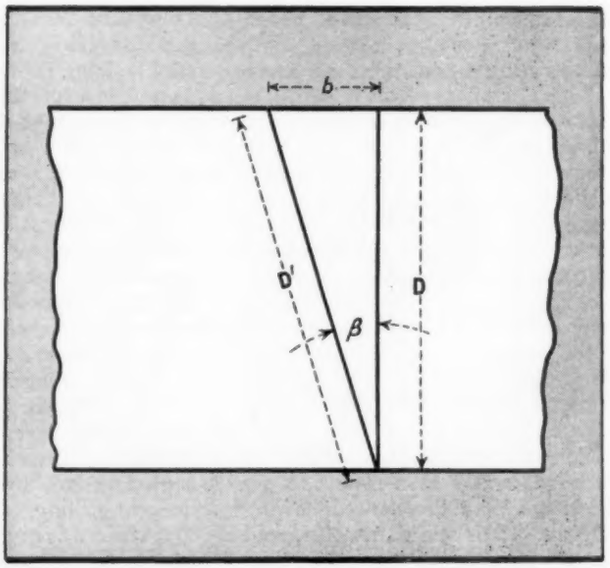


Fig. 14—A second source of error in bore gaging is the possibility of taking the measurement when the diameter measured is not at right angles to the bore

referring to equation $D_1 = 2r \cos. a$, it can be seen that $2r$ might be replaced with D so that this equation would then be written:

$$D_1 = D \cos. a$$

Comparing this with the previous equation, it is apparent that for a lateral error of placement in the bore, the diameter read is directly proportional to this angular displacement, but in the longitudinal displacement it is inversely proportional, so where one error tends to decrease the indicated reading the other error tends to increase it, and both in a like manner.

This explanation shows the need for providing any suitable bore gage with means of automatically determining at least one of these positions. The usual method is to eliminate the lateral error and allow the operator to manipulate the gage back and forth and observe the minimum size indicated, which then will represent the true diameter.

Friction Always Present

To accomplish this purpose, a pair of contact points attached to a single body constrained to move parallel to the measuring point in a perpendicular manner represents one of the most satisfactory and conventional methods. Many methods have been used to obtain this constrained motion parallel to the contact point. Some of these have advantages over the others, but in nearly all there exists a certain amount of friction, so that the force exerted by the locating points usually is greater when they are being forced inward than when they are moving outward, even though in exactly the same position. This has a tendency to alter the load placed upon the fixed measuring contact and thus produces a slight error in the readings because of a variation in the contacts' penetration into the surface of the metal.

Fig. 15—In this design the body holding the centralizing points is pivoted on a spring hinge

In any sliding unit, such as a rod fitted in a hole, there must always be a slight amount of play which allows these parts to shift from the ideal alignment desired. This amount of play will, of course, increase with wear, particularly where it is liable to contamination from abrasive or dust in the air, as well as dirt from the part measured.

The method shown in Fig. 15 eliminates this difficulty, in that the body to which the centralizing points are attached is pivoted on a spring hinge. In this manner the friction usually encountered at this point is eliminated.

The various methods of transferring the motion of the contact point down the axis of the bore have, in many cases, been quite ingenious.

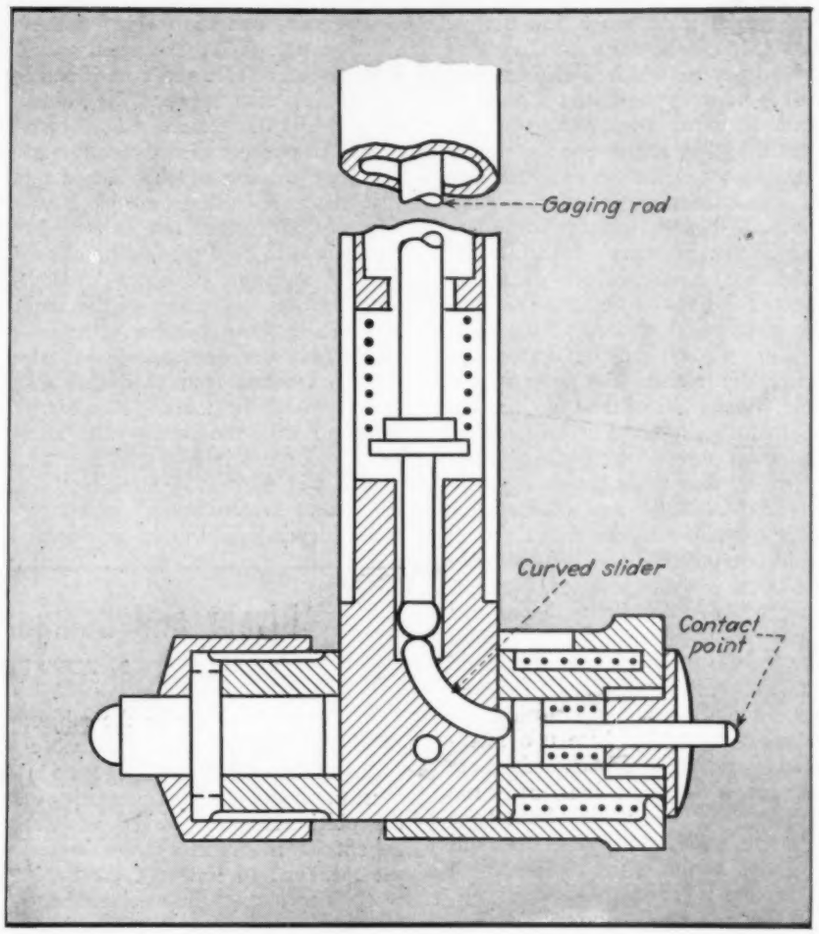


Fig. 16—A curved plunger in a curved slot transfers motion from the contact point down the axis of the bore in this type of gage head

Some have gone so far as to make a curved slot in which the quarter section of a ring is placed so that the contact point rests on one end and the gaging rod on the other. A motion causes it to slide around this curved slot, pushing the rod which is mounted in the frame of the gage. This method is shown schematically in Fig. 16.

Perhaps the bell crank has been used more generally than any other method. Its principle and construction is simple, and in most instances the friction produced by such a transfer mechanism is very low. The method shown in Fig. 15 almost completely eliminates friction at this point. Here the motion is produced by a flat spring placed at 45 deg., and therefore acting as a hinge so that the block to which it is attached must move outward the same amount as it is moved downward, and in that manner draws the attached rod with it. The indicator placed at the other end of the rod shows the movement of the contact point.

In considering the value of any

bore gage, there are a few simple tests that can be made to determine the fidelity to which the instrument will indicate the true size. It must be borne in mind when using such devices that they are, in essence, simply comparators, and at no time will give an actual measurement of the diameter. All that we can ask of such a gage is that it tell us faithfully the difference, if any, which exists between the bore being measured and the master ring used to set the gage.

This fidelity can be determined simply by placing the gage in the bore. The handle of the gage is raised so that the instrument reads plus, now when slowly lowering the handle it will be found that the gage gradually reads a smaller and smaller value until it finally reaches some minimum indication on the dial. This minimum indication should be noted. Now allow the gage handle to lower and then pull it upward slowly, gradually reducing the reading until again a minimum is obtained. Note, if any, the difference between the minimum values obtained by these two methods. If the difference exceeds more than one of the least divisions of the indicator dial, the value of the gage is questionable. Any gage that will give this minimum to less than $\frac{1}{2}$ a division is highly satisfactory.

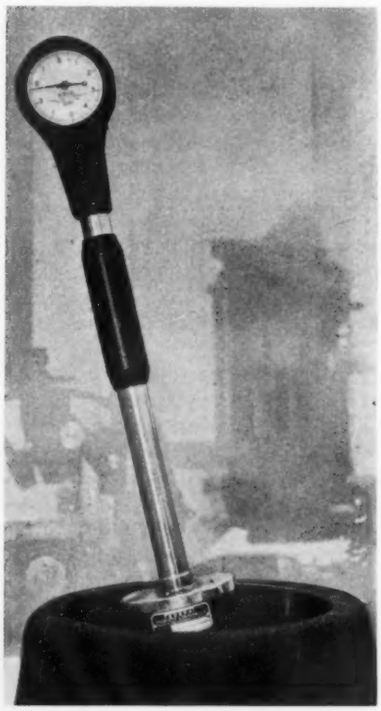


Fig. 17—The gage can be checked by holding it at about 15 deg. off the axis of the bore and observing the minimum reading when slowly swinging the gage

The next operation is to successively approach the minimum value from the same side and note if there is any deviation between the values obtained. If the greatest difference is equal to not more than two-tenths of the least reading of the instrument dial, the gage can be considered satisfactory. A further test that might be made is to hold the handle of the gage at an angle of about 15 deg. with relation to the axis of the bore and see if the minimum value obtained by the method previously described differs from the value obtained when the handle is actually lined up with the bore's axis. This latter procedure is shown in Fig. 17.

It is well to bear in mind that all mechanical instruments, excepting those depending solely on spring mechanisms, contain an appreciable amount of friction. When dimensions are considered in such small units as 0.00005 in. these frictional forces can easily deflect, compress and alter the relationship of the various structural parts of a device to magnitudes even greater than this value.

With care, good results can be obtained with instruments that exhibit even a fair amount of friction, if they always are manipulated in exactly the same manner each time. If this is done these frictional forces tend to produce the same errors in the same directions. Skilled operators can show surprisingly satisfactory results by observing this rule of measurement, even with bore measuring instruments that are not of the highest quality.

Direct and Comparison Measurements

By ROBERT S. ALEXANDER

C. C. STREET's article on the subject of direct and comparison measurements (*AM*—Vol. 84, page 565) must have brought back memories to the oldtimers who worked without benefit of micrometer and vernier, yet managed to turn out creditable work. Yes, it takes the mechanic who has seen the day of the firm-joint caliper and scale measurement to really appreciate the progress that has been made in accurate measuring devices. The younger generation of machinists would probably quit if you took away his outside and inside micrometers, then asked him to bore a large diameter hole so that a shaft already turned would be a driving fit in the hole. If he didn't quit in disgust, he would lose several pounds worrying before the job was complete and accepted.

When browsing through my library not long ago, I came across a book, "The Turner's Handbook on Lathe Work and Screw Cutting," by W. E. Wharton, published in England many years ago. I bought this book in 1917 while serving my apprenticeship. A few of the oldtimers among my shopmates carried this book in their tool-chests, much as machinists carry the *American Machinists' Handbook* in this country. One of my shopmates claimed to have worked with the author in the Royal Arsenal, at Woolwich, sometime in the nineties.

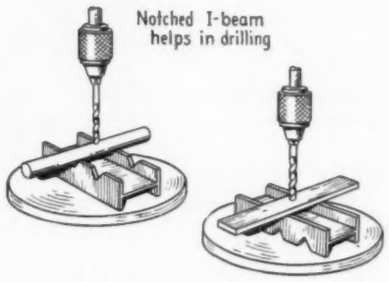
In this book the author describes a method of obtaining the above result that must be familiar to shopmen who were active at the turn of the century. The author points out that there is a standard which if worked to correctly will give no misfit or bad jobs when boring a hole to fit exactly a turned shaft, or to turn a shaft to fit a hole already bored. This standard for boring or turning is $\frac{3}{8}$-in. rock to the foot of a wire gage or calipers for a driving fit, and $\frac{1}{2}$ in. to the foot for a working fit.

As an example, the author takes a piston that is to be turned to fit a cylinder bored 24 in. in diameter. Make a wire gage to fit the cylinder so that it just touches as it is passed over the center. Then take dividers set to $\frac{1}{2}$ in. on the rule, and mark off from the center line thus obtained on both sides; this gives 1-in. rock set-out, which is the amount required for 24-in. diameter. Now ease the wire gage until it touches up to the line set out. It will take very little easing to accomplish this amount of rock, only a minute fraction of an inch being required. When turning the shaft or piston, set the calipers to the wire gage so that it can be felt to touch and finish the work at the same feel, having no spring on the calipers. This gives a perfect fit, without the need of taking the work out of the lathe to try it for size.

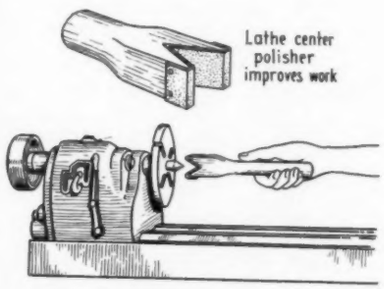
If the shaft already is turned and a hole is to be bored to fit the shaft, set the calipers to the job, then make a wire gage or set inside calipers to the outside calipers and bore the work. Take care to allow the amount of rock required; that is, $\frac{3}{8}$ in. for a driving fit, or $\frac{1}{2}$ in. for a working fit, for each foot of diameter.

SHORT CUTS FOR THE SMALL SHOP

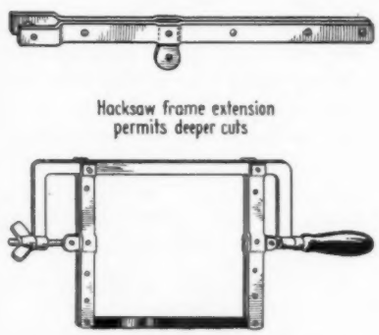
BY A. H. WAYCHOFF



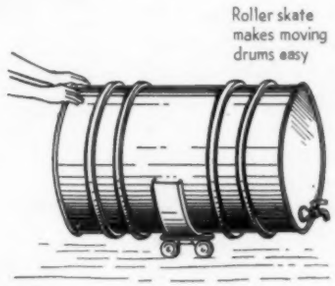
LESS BOTHER will be encountered when setting up work in small drill presses by using this short length of I-beam. It has a couple of pairs of V notches cut in the flanges on one side, with those on the other side left as is. With it both round and flat work can be firmly supported, with plenty of clearance under the work for the drill to break through.



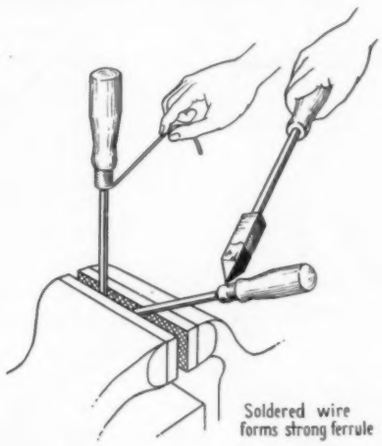
BETTER WORK on lathes is possible by keeping the centers nicely polished. One of the easiest ways to do this is to use a hardwood stick with a 60-deg. V-notch in one end, with emery glued inside the notch. This polisher used once in a while with the lathe running will keep the center point smooth and bright so it won't start cutting.



MOST HACKSAW FRAMES aren't deep enough to take care of some jobs, and few shops have a special deep frame. Shown is an arrangement that takes less than a minute to slip on, and will do the work fine. Each end link is made of two steel strips about three-quarters of an inch wide and an eighth of an inch thick. The little strips that catch the blade-holding pins in the frame can be made from an old butcher knife. They're riveted between the strips forming the end links, which are riveted at a few other places also. Then a couple of holes drilled in the hacksaw frame, four pins, and the device is ready for use. By turning the wing nut the blade tension can be adjusted in the usual way, and the attachment can be removed or replaced in a jiffy.

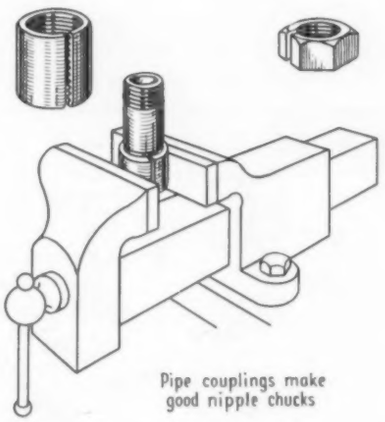


A HANDY TRUCK for all sorts of drums and barrels may be made by cutting a rather wide auto wheel or tire rim in two and then riveting it to an old roller skate. In use the barrel is simply rolled over the cradle with the cradle placed in the center. Then a man can easily take hold of one end of the drum and roll it in any direction, getting in close places where it would otherwise be impossible.



GOOD FERRULES for small hand tools can be made by winding the handle where the ferrule is to be with fine copper or brass wire. Wind the wire smooth and tight, and with a hot iron flow solder all over it. Then dress off the solder with a fine file till the wires just show. This makes a very light ferrule, with many times the strength of a piece of sheet metal.

EXTENSION CORDS usually are wadded up and thrown in some corner when they're not in use, making them tangled and knotted, and fraying the insulation till it's dangerous. A way to protect the cord and find it easier is to wind it up on an ordinary little clothesline reel such as sold in ten-cent stores. Remove the clothesline and drive a small pin about half an inch long through the spindle. Then, with the reel mounted in some convenient spot, just double the cord, hook the loop over the pin, and start cranking. Next time you want it you know that it's in the right place, and that it's not all tangled up or shorted.



MECHANICS DOING PLUMBING or repair work will find this method of holding nipples much better than the common wrench or nipple chuck ideas. With a hacksaw split one side of an old coupling of the right side, screw in the nipple and clamp the coupling in a vise. Just a light pressure holds the nipple tight enough for threading and cutting, and there isn't a chance of damaging the threads. Studs and bolts can be held the same way by cutting through one side of a suitable nut.

IDEAS FROM PRACTICAL MEN

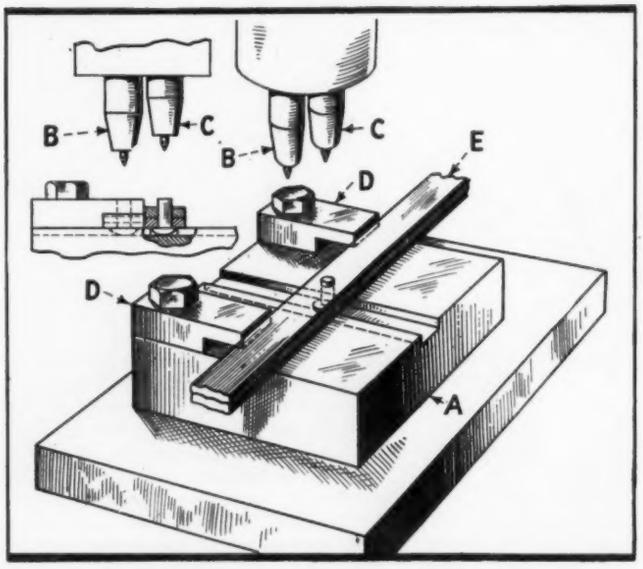
Double Die Speeds Riveting of Thin Sheets

By L. KASPER

We make a product of strip steel riveted together at specified points with hollow rivets, the work being done in a punch press. Two different thicknesses of material are used; at some points, two thicknesses of the heavier material are riveted together while at other points, the thinner material is riveted together. Ordinarily, the heavier pieces would be riveted together and the press then reset for the lighter pieces; however, cost of the article being produced did not permit of the additional handling. Therefore, the method shown in the drawing was adopted.

The die block *A* is fitted with two stops *D* for locating the material under the punches. Block *A* is grooved for receiving the rivet head, as shown. Two punches *B* and *C* are carried in the punch holder, punch *B* being longer than punch *C* by an amount equal to the difference between the two thicknesses of strip to be riveted. Punch *B* is located directly behind punch *C*, over the center of the groove.

In operation, the rivet is inserted in the holes in the two pieces *E* with the head of the rivet located in the groove in the die block *A*. The work *E* is then slid toward the rear until it contacts the stops *D*. If two heavy thicknesses are being riveted, they will contact the projecting portion of the stops *D*, which will locate the rivet in line with the shorter punch *C*. If, however, two of the lighter sections are being riveted, they will pass under the projecting sections of stops *D*, coming to rest under the longer punch *B*. In the drawing, two of the heavier pieces are shown in section, while two of the lighter pieces are shown dotted, indicating the positions they occupy when the punches descend.

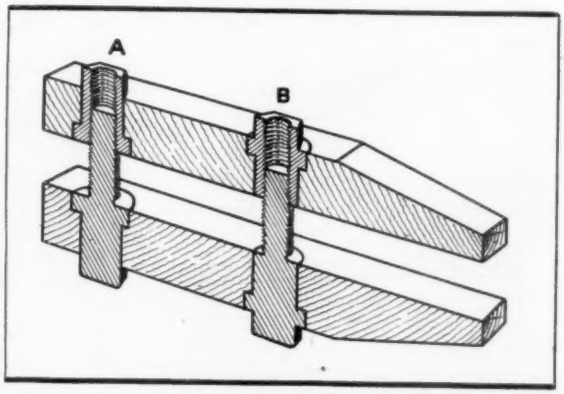


Punch press dies were arranged in this manner to rivet two thicknesses of heavy sheet or two thickness of light sheet, without changing the dies

Non-Interfering Screws for Parallel Clamps

By C. G. WILLIAMS

The conventional parallel clamp, with screws projecting in opposite direction from the jaws, often interferes with some part of the clamped work, especially when the latter is on a machine table. Here is a design which overcomes much of that difficulty.



The nuts and bolts of this parallel clamp do not extend far enough beyond the surface of the jaws to interfere with most types of clamped work

The screws of the illustrated clamp do not extend much beyond the jaws, and they can be tightened from either side. It will be seen from the drawing that both jaws of the clamp are exactly the same, that the nut *A* is countersunk from the inside, while the nut *B* is countersunk from the outside; both nuts are threaded for their entire length. The nuts and the heads of the bolts extend only far enough beyond the surface of the jaws to permit tightening with a wrench.

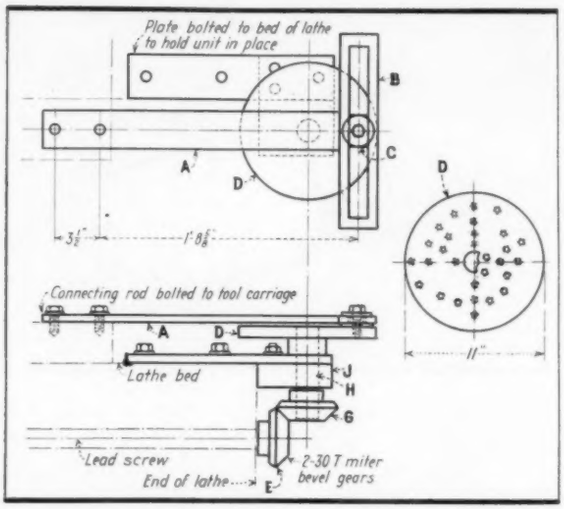
Lathe Attachment for Grooving Bushings

By ROBERT C. SMITHYMAN
Alliance Machine Company

The accompanying illustrations show a lathe attachment developed and built by the Alliance Machine Company for turning oil grooves in bronze

bearings. Hand or air chipping was a slow process and the grooves were not uniform. With the device here shown, bearings up to 6 in. diameter and 8 in. long were grooved in 90 sec., including time for setting up.

The problem was to find a method of feeding the tool. The ordinary feed on a lathe is not fast enough



A scotch-yoke attachment for grooving bushings, mounted on the end of the lathe bed and connected to the carriage, moves the tool forward the length of the bushing in one-quarter to one full turn of the faceplate

as the tool must travel the length of bushing in one-quarter to one full turn of the faceplate of the lathe. This was solved by designing a feed attachment for the lathe.

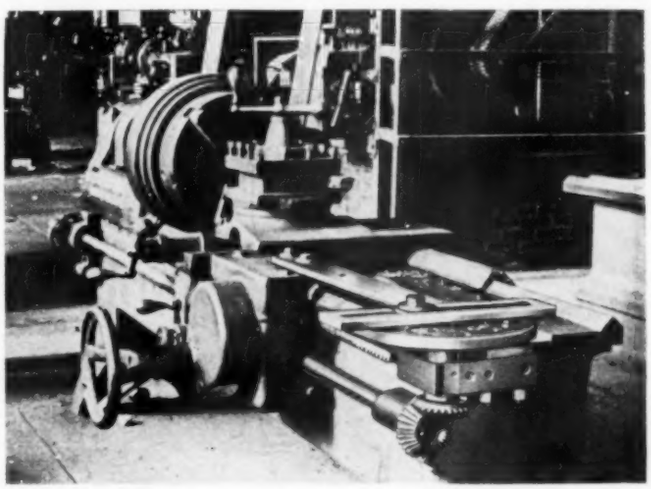
This attachment, designed to fit on the end of the lathe, consists of a connecting rod which is bolted to the tool carriage. The connecting rod, shown as *A* has a slotted bar *B* at the end opposite that which is bolted to the tool carriage. This slotted bar is fitted with a bronze slide block *C*, which is bolted to a turntable *D*. When the table revolves, this scotch yoke moves the carriage back and forth, thus oscillating the tool in and out of the bearing.

To rotate the turn table, a set of miter gears is used. One gear *E* is fastened to the end of the lead screw. The other gear *G* is fastened to a shaft *H* welded to the turntable. Therefore, a definite tie-up is made between the speed of the lathe spindle and the speed of the tool feed. The ratio between the two can be changed in the usual way of changing the gear ratio at the end of the lathe.

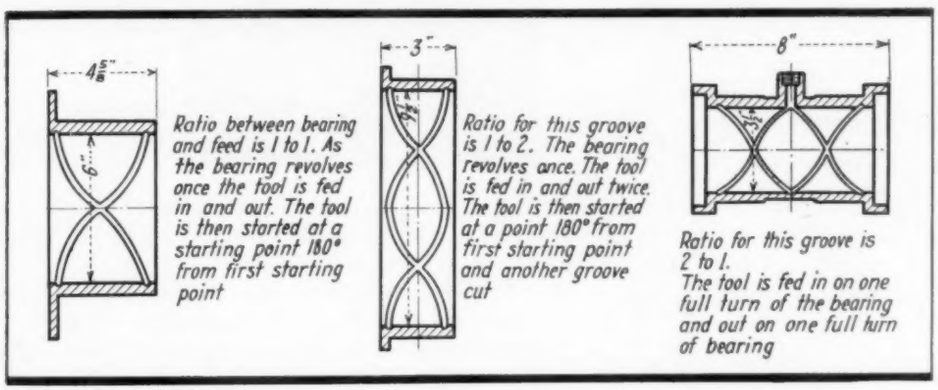
The complete unit is fastened to the end of the lathe by a steel block *J*, which is bolted to the bed of the lathe between the ways in such a manner that the tool carriage can pass over it. The steel block has a hole through which the shaft passes. Holes are drilled in the turntable to obtain a different length of stroke for different length bushings.

The use of the slotted bar and slide block on the connecting rod makes possible the desired harmonic motion so that the oil grooves will intersect in the center of the bushings when the rotational speeds of the faceplate and slide and the length of the connecting rod *A* are such that the tool goes in on one turn of the plate and out on one turn.

The tool is placed in a bar and is ground in such a way that it will cut when the tool is fed either way



The harmonic feed of the grooving tool depends upon the relative speeds of the spindle and carriage. The ratio between speed and feed can be adjusted by indexing the turntable, thereby changing the length of the connecting rod


4⅝"
Ratio between bearing and feed is 1 to 1. As the bearing revolves once the tool is fed in and out. The tool is then started at a starting point 180° from first starting point
3"
Ratio for this groove is 1 to 2. The bearing revolves once. The tool is fed in and out twice. The tool is then started at a point 180° from first starting point and another groove cut
8"
Ratio for this groove is 2 to 1.
The tool is fed in on one full turn of the bearing and out on one full turn of bearing

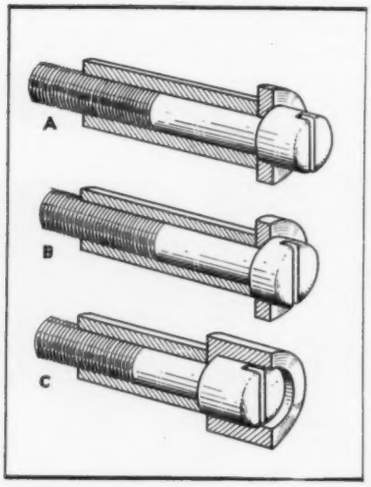
These three types of grooves can be cut in bearings in 90 sec. or less, including time for setting up the job

through the bearing, forming an endless groove. The tool is then started in again 180 deg. from the point where the first groove was started and another endless groove machined.

Stripper Screws of Variable Length

By H. R. HAGEMAN

Quantity produced shoulder screws designed for limiting the travel of stripper plates on punch and die work have become quite popular because of their convenience. But they have a few objectionable features which are overcome in the type of screw shown in the drawing. It will be noted that in each of the three different screws shown the shoulder is formed by slipping an ordinary fillister head capscrew through a



These fillister head capscrews, slipped through a piece of tubing, overcome some of the objections of shoulder screws used for limiting the travel of stripper plates on punches and dies

piece of tubing of the required length with a special washer under the head.

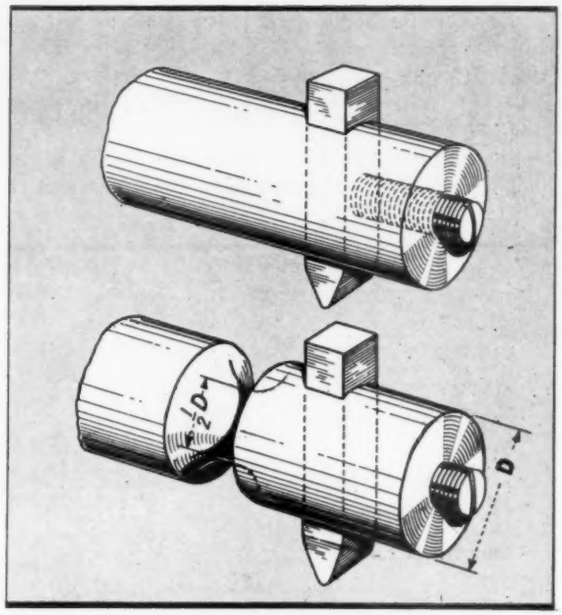
This is a decided advantage over the solid shoulder screws, and makes it unnecessary to stock so many special screws. They are not so liable to break because of no sharp corner at the shoulder, and should they break they can be replaced at little cost. They can be shortened readily to compensate for wear of the punch steel, thus maintaining the proper amount of travel on the springs.

In the absence of tubing of the required dimensions, iron pipe can easily be adapted, $\frac{1}{8}$-in. pipe for $\frac{1}{4}$-in. and $\frac{5}{16}$-in. screws, $\frac{1}{4}$-in. pipe for $\frac{3}{8}$-in. screws, and so on.

A Niched Boring Bar Reduces Chatter

By ARTHUR L. GREENE

Niching of a boring bar to half its diameter just above the cutting section will reduce vibration and chatter and increase production approximately 25 per cent. This is the finding of Henry O. Luther, specialist in precision machine work at the Package Machinery Company. Work with the new bar shows that the cutting tools have much greater life between



The theory behind this niched boring bar is that the spring in the bar provides a wrist action which takes up shock and vibration

grinds, and that they may be run at about 25 per cent higher speed without vibration and chattering.

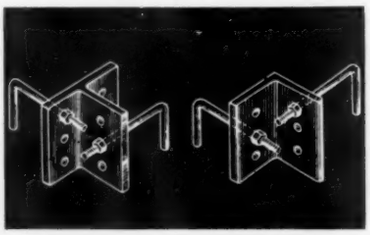
All bars used on the company's jig boring machines are now being turned down to take advantage of this fact. The bar can be niched, or it can be gradually necked down until the narrowest point is reached about $1\frac{1}{2}$ in. above the bar head.

The theory is that the niching of the bar gives a certain spring and provides a wrist action which has a tendency to take up shocks and vibration coming to the bar from the boring tool. In this way the amount of vibration transmitted to the bar itself is cut down.

Simple Clamps for Assembling Welded Structures

By F. SIDNEY

A few well-positioned clamps greatly assist erecting and assembly operations, especially on light welded



Steel sections fitted with hook bolts make convenient clamps for assembly operations, especially on light welded structures

structures. Two of the many types of clamps are shown in the illustration. Both are of simple design and made from steel sections.

The one made from angle section is useful for corner and cross-wise holding of parts. The clamp made from the T-section is handy for junctions, where the work lays in vertical and horizontal planes.

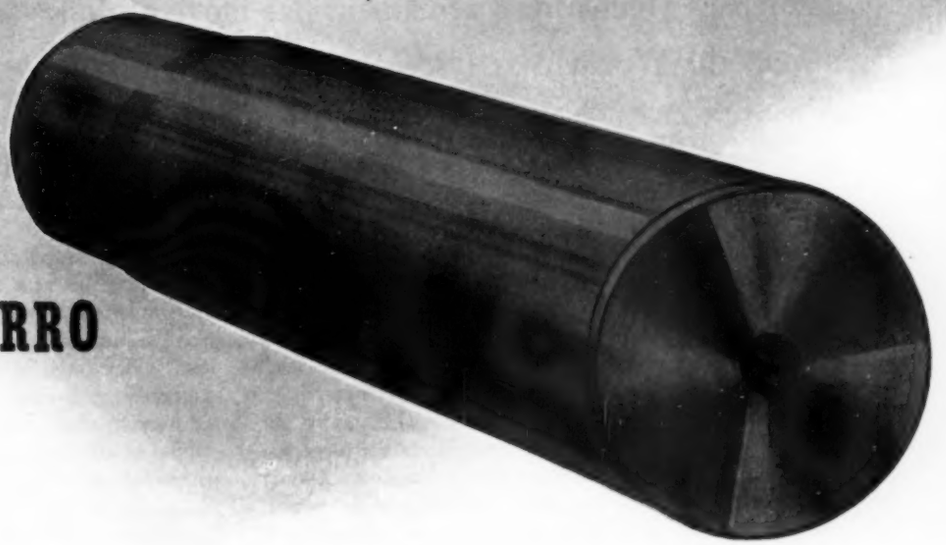
Armament

SECTION OF AMERICAN MACHINIST

DYNAMICS OF DEFENSE

BY MAJOR ROBERT GINSBURGH

HOW TO MAKE ARTILLERY CARTRIDGE CASES



BY FRANK J. LERRO

DYNAMICS OF DEFENSE

The medium tank is a land battleship, weighs more than 20 tons and has armor heavy enough to resist 37-mm. guns

France dug in and then caved in, a tragedy of static defense. Mechanized armament has moved a long way since the World War. Here are some of the trends

BY MAJOR ROBERT GINSBURGH, U. S. ARMY

Assistant Executive, Office of the Assistant Secretary of War

More power! More speed! More protection!

Every general staff is calling upon its technical experts for armament that will combine all three factors. Yet the mere recital of these requirements indicates that they are not reconcilable with each other. The more the power, the greater the weight, and therefore, the lower the speed. The more the speed, the lighter the bulk, and therefore, the less the power. The greater the protection, the heavier the weight, the less the speed, and the less the power.

Strange as it may seem, however, there is a decided trend in the armament of all great powers to realize this combination with unprecedented efficiency. The reason? The modern internal combustion engine.

Consider, for example, the tank or the combat car. No longer is it the cumbersome vehicle of yesterday, moving at four or five miles an hour protecting slow moving infantrymen while affording cover to its own operating crew. Its basic requirement of force has not been abandoned. On the contrary, it has been increased. The most modern types carry not only heavy machine guns but light artillery. They move at 40-mile-an-hour speeds, and

they carry protective armor that tends to resist even 37-mm. anti-tank guns; they are not always stopped by 75-mm. ammunition. From Finland and from France have come reports of 70-ton tanks used by the Russians and the Germans respectively.

So far, the United States Army has announced that it is producing light and medium tanks. Our light tank carries a crew of four men and has armament which equals the fire power of at least 50 men with rifles. It weighs about ten tons and can run at high speeds both on roads and over rough terrain. It can knock down trees six inches in diameter and has armor thick enough to keep out ordinary .30 caliber bullets. With its great speed and cross country mobility it is as hard to hit as a rabbit.

The medium tank is much larger and heavier than the light tank, carries more powerful guns, and has a crew of six men. It is, in fact, a land battleship capable of crossing wide trenches, knocking out machine gun nests and overcoming strong enemy resistance. Its armor is heavy enough to keep out much heavier projectiles than that of the light tank. It weighs more than 20 tons and has a road speed of around 30 miles per hour. It has a powerful engine, protected by armor and carries a liberal supply of gasoline likewise protected. The armor is relatively thick, and can repel most small arm projectiles.

The Iron Horse Joins the Army

The American combat car, the "heart" of the mechanized cavalry, is a light tank, protected by armor and equipped with the weapons needed to accomplish the tasks appropriate to that arm. The vehicle weighs about eight tons and has a maximum speed of about 50 miles per hour.

Whenever an innovation in armament is introduced by one country, the others logically follow. Heavy tanks have been noted in Europe; and America is studying, experimenting and testing their possible value in our own mechanized program.

The interplay of the triumvirate, power, speed and protection, appear in aviation in a manner even more spectacular than they do in the tank or combat car. General staffs are demanding increased armament both in the number and in the caliber of the guns mounted on the plane. They call for terrific speeds not only in pursuit ships but even in heavy bombers. They ask for heavy armor plate so placed as to protect the pilot from hostile fire.

In the early stages of the present war, there was a tendency to think principally in terms of speed and power, but as casualties among pilots multiplied, the protective factor assumed greater importance. A trend toward heavier protective armor has been found among the warring nations.

The trend toward leak-proof gasoline tanks is indicative of a similar desire for greater protection. These have greatly reduced the effectiveness of .30 caliber bullets and have tended, therefore, to make the plane far less vulnerable than in the past.

To counteract this development, heavier machine guns and even cannon are being mounted in cockpits overseas. These, in turn, increase the weight of the planes and should tend to reduce speed, yet there is no indication that the fighters or the bombers are moving any slower. The increase in weight caused by the added armor is met, in some cases, by a reduction in the number of the crew. The need for armor has also been reduced by development of more effective fire power at greater distances.

A trend by definition precludes stabilization; and in aviation, especially, it is difficult to conclude which of the three factors, of power, speed, and protection, at any given moment has the upper hand. Fluctuations are continuous.

The P-38, which the Army Air Corps regards as the best interceptor pursuit airplane in the world today, is an illustration of the trend in America. Heavily armed, it is capable of more than 400 miles per hour. It has a range of 600 miles or more. It has leak-proof tanks, and provides armor protection for the pilot to include .50 caliber bullets.

Modern Doughboy Uses Many Weapons

Let us now turn to less spectacular armament, though in the final analysis, as important as planes or tanks. An army essentially is a team effort, and a weakness in any type of machine or weapon is likely to develop a point of vulnerability of which an intelligent enemy will take advantage. It is wise always to assume that the enemy will be intelligent and to prepare accordingly.

In the infantry, the trend toward power has multiplied the number and types of weapons needed for the doughboy. There was a time, and not so long ago, when infantryman and rifleman were synonymous. Today he pushes the assault with pistol, grenade, rifle, bayonet, machine gun and mortar, supplemented by tanks, field artillery, and airplanes.

For speed, he depends on fast moving trucks that carry him close to the battle lines or move him quickly to other sectors when the situation demands. This trend does not mean that the three mile an hour feet of the doughboy no longer serve in battle. On the contrary, reports from overseas indicate that there is still plenty of marching and countermarching. Examples of infantry moving on foot day after day, ten, twenty and even thirty miles are common despite the introduction of mechanized means of transport.

For protection, he depends on his own anti-tank and anti-aircraft guns and on his supporting planes and artillery.

In small arms used by the infantry, the trend is away from the manually operated rifle to the semi-automatic, a combination of speed and accuracy. The American Garand probably represents the best in the semi-automatic field. It will supersede the old reliable Springfield which has been

recognized for many years as the most efficient bolt action military rifle in the world. With the new gun, no manual operation is necessary between shots. The rifleman maintains his aim on the target and fires by squeezing the trigger for each individual shot. It uses the same ammunition as the Springfield and is equally accurate. A trained rifleman can fire 60 aimed shots per minute as compared with the rate of fire of only 15 shots per minute with the old standard rifle. It weighs approximately nine pounds, and its most efficient rate of fire is about two and one half times that of the Springfield. It can be fired with considerably less fatigue on the soldier, due to its reduced "kick".

The Garand uses ammunition more rapidly and, therefore, adds to the difficulties of supply. Its production in mass is taking considerable time, but once it becomes available to every rifleman, it is expected to meet the most exacting demands of the modern doughboy.

In machine guns the trend is toward greater numbers of light automatic weapons with higher rates of fire. In Europe, water-cooled machine guns are giving way to air-cooled types. In our own Army the basic machine gun is the caliber .30 Browning. It has a maximum rate of fire of approximately 500 rounds per minute with a range of about three miles which is approximately 50 per cent greater than the World War type.

Since the World War, the Army has added the heavier .50 machine gun. The mechanism of this gun is almost identical with that of the lighter Browning. It is of the recoil type, belt fed, and water cooled. It has a maximum rate of fire of about 400 rounds per minute with maximum range of approximately four miles.

Unpopular World War Mortar Superseded

The trend toward greater infantry fire power is reflected in the increase and development of mobile mortars. The small World War Stokes, with its tumbling trajectory, limited range, and characteristic tell-tale sound, was despised by front line troops because it invariably disclosed their positions. In its place, the American infantrymen will use 60 and 81-mm. mortars.

The 60-mm. mortar is a direct fire weapon and has a maximum range of 1900 yards. The minimum safe range is 75 yards which is just beyond that of hand grenades. The projectile weighs slightly more than three pounds. The total weight of the mortar and all accessories is approximately 50 pounds, and it is easily carried by two men.

The 81-mm. mortar fires projectiles weighing about seven pounds to a range of some 3200 yards, but the propelling charges are arrayed in increments so the shell can be fired at elevations varying from 45 to nearly 80 degrees, thus permitting plunging fire at short ranges. This weapon can be transported on pack mules, on hand carts, on animal-drawn carts or in trucks.

To protect the doughboy against modern enemies, he is now furnished anti-tank and anti-aircraft guns.

In the anti-tank field, the trend is toward greater power. Since the tendency in tanks is thicker and thicker armor, a parallel development of projectiles that can penetrate deeper and deeper must keep pace. At the outbreak of the present war, the European nations put their faith in anti-tank guns in the 37-mm. class. Today the trend is toward a much heavier weapon, perhaps not as great as the French 75 which unexpectedly had to wheel into action, but certainly to something greater than the 37.

For the present, the American Army is equipping its infantry with a 37 that can defeat the average modern armored target. It throws a projectile weighing almost two pounds at a speed of half a mile per second. It covers a front of 45 degrees and can be operated by one man. It can be towed at any speed behind a truck, and is light enough to be manhandled by the regular crew. It has a simple telescopic sight so arranged that one man can control and fire the gun with a minimum of effort. It has proved itself by test to have extraordinary accuracy on stationary and moving targets.

For Bringing Down "Hedge Hoppers"

The high speed low flying attack plane has caused a trend toward equipping infantry with an anti-aircraft gun, more powerful than a machine gun, but not large enough to be included in the category of light artillery. The recently developed American 37-mm. anti-aircraft gun is illustrative of the tendency. It is mounted on a mobile carriage which may be towed by a truck at high speed. It is capable of getting into and out of action almost instantaneously, is mounted for all around fire on a four wheel trailer, and operates under the same principles as a machine gun, though not quite as fast.

Light artillery, like planes and tanks, show a tendency toward greater mobility and greater power. In the trend toward greater mobility may be noted the new split-trail carriage for the French 75 which can be towed at great speed by fast moving trucks. When ready for action it can raise its elevation to fire up to eight miles instead of five as it did during the World War; and without shifting position it can sweep over an area of 1200 mils in contrast to the 1917-18 zone of about 100 mils.

While the trend toward motorized artillery has been pronounced, it is worth noting that in the German army horse-drawn artillery is still the rule rather than the exception. Practically all of its infantry divisions, which represent 80 to 90 per cent of the total ground forces, have field artillery drawn by horses.

Not content simply with modernizing its 75 carriage, the American army is following the trend

toward a heavier divisional field piece. It has adopted a 105-mm. howitzer for distribution to the field artillery as soon as produced in sufficient quantities. This shift to a heavier weapon was most pronounced in Germany where the 77-mm. gun, of World War model, gave way entirely to the 105-mm. howitzer. Germany, limited to 300 pieces of field artillery of all types by the Versailles Treaty, had no investment in old guns to protect when it decided to arm. All other countries had World War types in large numbers which they felt they could not scrap. Their heavier field pieces were in the blueprint stage when Germany struck with the real howitzers.

The increase of calibers of divisional field pieces has been paralleled by similar increases in calibers of anti-aircraft artillery. As planes fly higher and faster, the demand arises for greater range and higher muzzle velocity. As they add armor, the call comes for more powerful projectiles with greater fragmentation radii.

The French 75, which served so well during the World War, has been modernized to give it greater mobility and increased range of fire

Heavier Anti-Aircraft Gun Adopted

In the 3-in. anti-aircraft gun, the American Army has an excellent mobile weapon for use against enemy planes flying at considerable altitude. It fires a 12.7-lb. high explosive shell to a height of approximately six miles. From 25 to 300 accurately aimed shots can be fired from this gun per minute. It is mounted on a carriage with pneumatic tires and anti-friction bearings which permits towing behind trucks at high speeds. In firing, the weight is removed from the wheels by means of lifting jacks. A well-trained gun crew can go into action from the traveling position in approximately fifteen minutes.

In the light of experiences abroad, which indicate the need for even more powerful anti-aircraft weapons, the Army now has begun production of a 90-mm. gun that can fire higher, faster and inflict damage over a wider radius.

In the heavy field artillery, changes have been few. There is a trend toward mounting heavy guns on mobile carriages and away from fixed fortifications. For the protection of port entrances, the permanently emplaced gun is still of major importance.

Developments in heavy artillery carriages have contributed to increases both in range and speed. An example of such improvement is found in the combined 155-mm. gun–8-in. howitzer carriage upon which either of the two field pieces can be mounted. This carriage is equipped with pneumatic tires and air brakes which permit the gun to be towed behind high speed trucks. In firing position, the carriage does not rest on the wheels but is lowered to the ground by self-contained jacks. The range of this weapon is approximately fifteen miles, which is 50 per cent greater than that of the World War type.

The trends in individual weapons are reflected in their employment. It must be remembered that it is in their combined use in an intelligent manner that the technique and the resultant tactics and strategy of the Army as a whole come into play. Power, speed and protection in each weapon and in their combined employment—there is the modern formula in armament. America has noted the trend and is preparing accordingly.

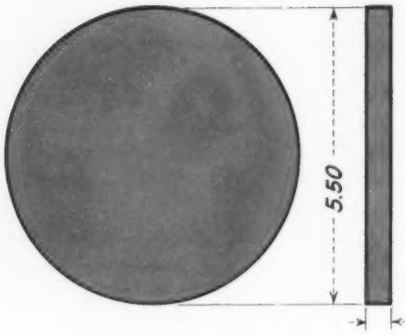


Fig. 1—*A disk of the dimensions shown provides the raw material for the 75-mm. cartridge case. Obtaining the metal in this form, rather than sheet, saves handling of scrap*

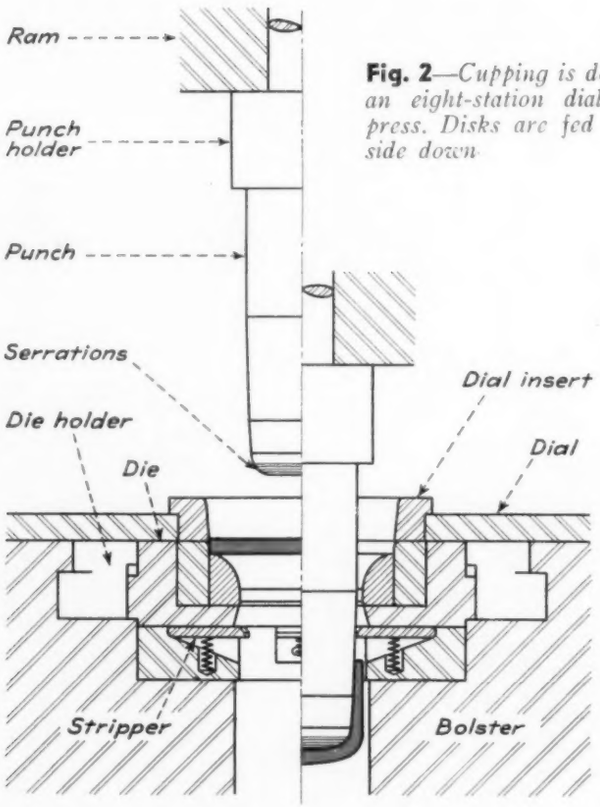
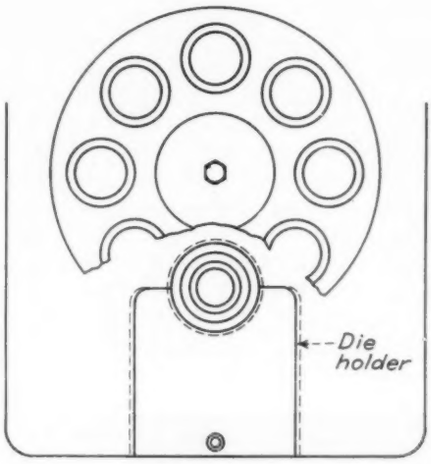


Fig. 2—*Cupping is done in an eight-station dial feed press. Disks are fed sharp side down*



Top View

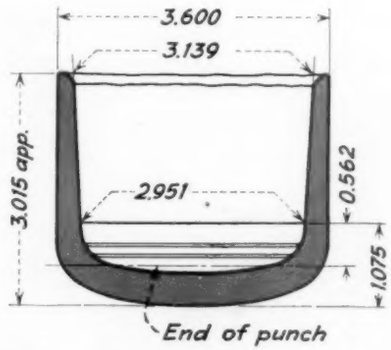
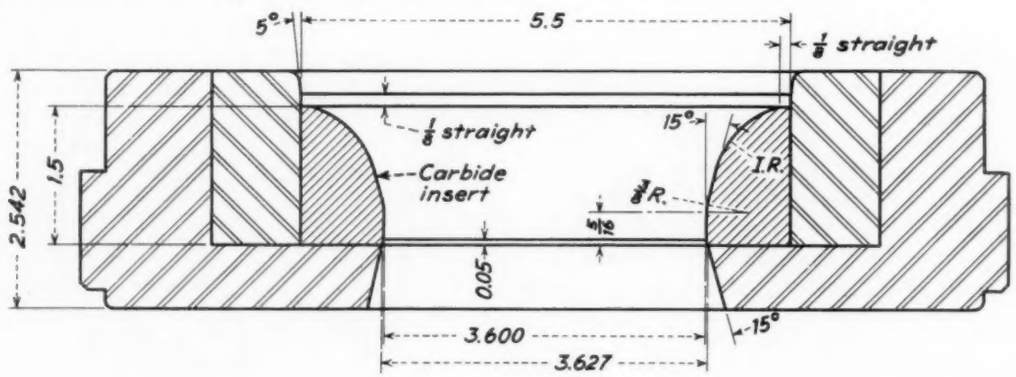


Fig. 3—*Cups are drawn to these dimensions. They must be free from grooves that will carry through to subsequent redraws*

Fig. 4—*A sectional view of the cupping die shows the carbide inserts on the sections receiving the greatest abrasion*



HOW TO MAKE ARTILLERY CARTRIDGE CASES

A companion article to "How to Machine 75-mm. Shell" (AM—Vol. 84, page 667) tells of the latest tooling for press work and machining operations on the cartridge case

BY FRANK J. LERRO

Foreman, Artillery Cartridge Case Shop, Franford Arsenal

WITHIN the past few years many improvements have been made in the manufacture of artillery cartridge cases at Frankford Arsenal. The 75-mm. cartridge case is offered as a typical example of the tool development being carried out to reduce the number of operations necessary in the manufacture of cartridge cases without sacrificing quality.

During the last war and until recently, this particular cartridge case was made in five redraws with an indenting operation in between to obtain necessary metal for the heading operation. It now is made in three redraws with no indenting operation required between them.

The following is the method used at Frankford Arsenal to manufacture the 75-mm. cartridge case.

The first operation is the cupping of a commercially procured disk of dimensions shown in Fig. 1. This disk is made of cartridge brass (70 per cent copper—30 per cent zinc), having a Brinell hardness (500-kg. load, 10-mm. ball) of 43 to 65 and a tensile strength of 40,000 lb. per sq. in., with a grain size of 0.055-0.115 mm. magnification × 75.

This operation is done on a mechanical press equipped with an eight-station dial feed. It is cupped as shown in Fig. 2. The final dimensions of the cup are shown in Fig. 3.

The disks are fed into the die nest, sharp side down, to obtain the best drawing edge for subsequent redraws. If this drawing edge has the slightest gutter around the middle of the side wall at the top of the cup, it will form a gutter or groove on the inside surface of the side wall in the following redraws and, in all probability, cause a tearing of the metal at this point. This is caused by the metal of the side walls tending to fold around the punch while drawing through the die.

Because of the importance of proper design of the cupping die, a detailed view, Fig. 4, is shown along with the set-up sketch. The design of this cupping die, along with the serrations on the nose of the punch, has proved satisfactory in holding enough metal at the base to permit heading the cases without relying on an indenting operation to accumulate enough metal to do so.

One hundred and twenty-five tons are required to perform this operation. The drawing speed used is approximately 75

ft. per min. The reductions in wall thickness vary from 30 per cent at the bottom wall to 50 per cent at the top wall of the cup, along with a reduction of 35 per cent of the disk diameter.

Following this operation and after the first and second redraws, the cases are annealed in batch-type furnaces to a temperature of 1,125 F. and are left in the

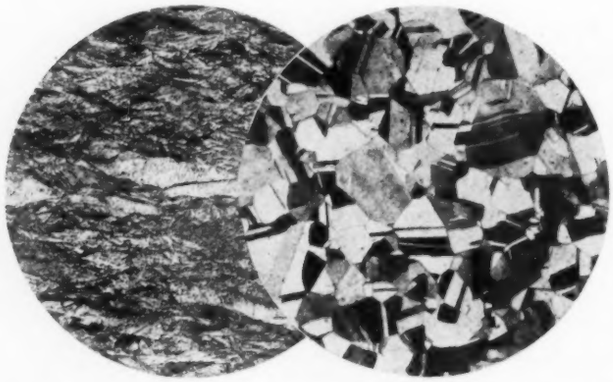


Fig. 5—*The elonged grain structure (left) is broken up by annealing to put the work-hardened metal in condition for the following operations*

furnaces to obtain the following grain sizes at mag. × 75:

After the cupping and first redraw 0.060-0.080 mm.

After the second redraw. 0.035-0.045 mm.

Fig. 5 shows the grain structure of the metal after the cupping operation and after it has been annealed to a grain size of 0.065-0.075 mm., mag. × 75.

It might be well to mention here that it is useless to give the limits required to obtain these grain sizes as they depend on the type and efficiency of the furnaces used to anneal cases. At Frankford Arsenal, the furnaces average approximately 2,000 lb. per hr. and are of the forced convection type.

After the cases are annealed, the basket, containing annealed work, is lowered into a large tank and sprayed with cold water. This same basket (15 per cent chromium —35 per cent nickel) is carried into another tank containing a 12 per cent (by weight) sulphuric acid solution. The cases remain in this solution for approximately 2½ min. after which they are lowered into Tank 2 for a plain cold-water rinse; next they are placed in Tank 3 containing a soap solution (0.2 per cent by weight of soap chips, 0.2 per cent by weight of alkaline cleaner and the remainder water) maintained at a lukewarm temperature to prevent excessive lather. Finally they are washed in Tank 4, containing plain hot water to rinse the cases thoroughly and quicken drying. The cases are then ready for the following redraws.

The first redraw is performed in the same manner as the cupping operation using a mechanical press equipped with a dial feed. Seventy tons are required to perform this operation, and a drawing speed of 65 ft. per min. is used. The reductions taken on this redraw are 35 per cent at the bottom of the case and 60 per cent at the top of the side wall. Figs. 6 and 7 show the set-up for this operation and the final first redraw dimensions.

Hydraulic Press for Second Redraw

The second redraw operation is done on a high-speed hydraulic press; the work is fed into the die (Fig. 8) manually as the stroke required gives the operator ample time to have the work ready for the next stroke of the press. This operation requires approximately 35 tons working pressure, and the drawing speed used is 40 ft. per min. The reduction in wall thickness varies from 40 per cent at the bottom of side wall to 50 per cent at the top. For final second redraw dimensions see Fig. 9.

The third and final redraw (Fig. 10) is carried on in the same manner as the previous operation with the exception that the working pressure required is 30 tons and the drawing speed 35 ft. per min. The reductions (Fig. 11) taken here are from 50 per cent at the bottom of the side wall to 30 per cent at the top. This governs the final physical requirements of 85,000 lb.

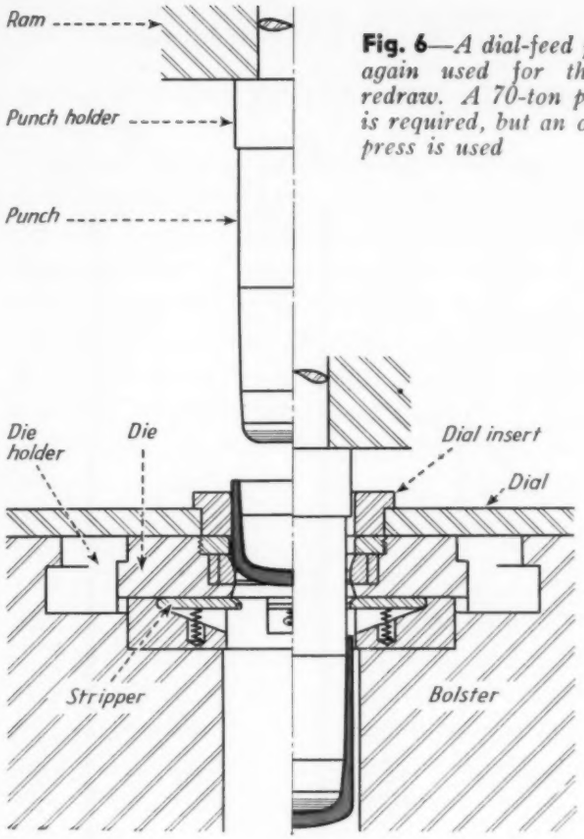
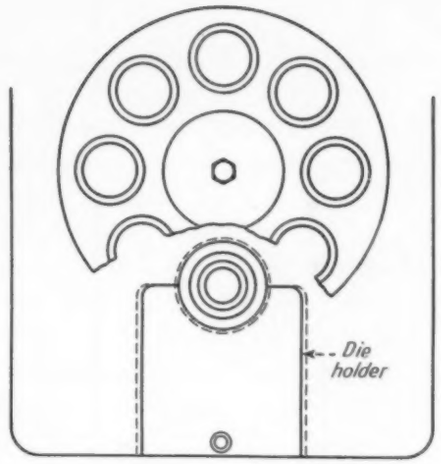


Fig. 6—*A dial-feed press is again used for the first redraw. A 70-ton pressure is required, but an oversize press is used*



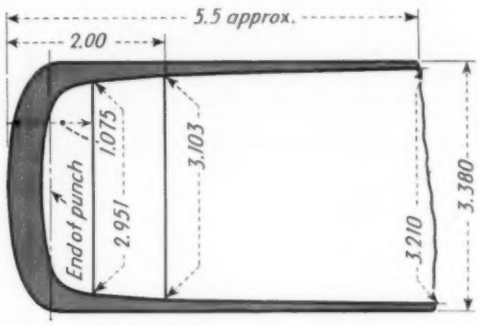


Fig. 7—*Dimensions of the first redraw show a 35 per cent reduction at the bottom, 60 per cent at the top*

Fig. 8—*The case is hand fed into the die because the length of the stroke renders dial feed unnecessary*

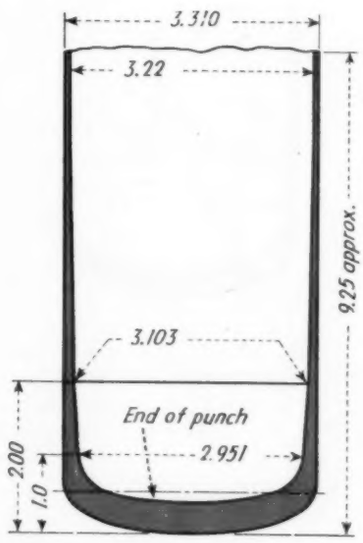
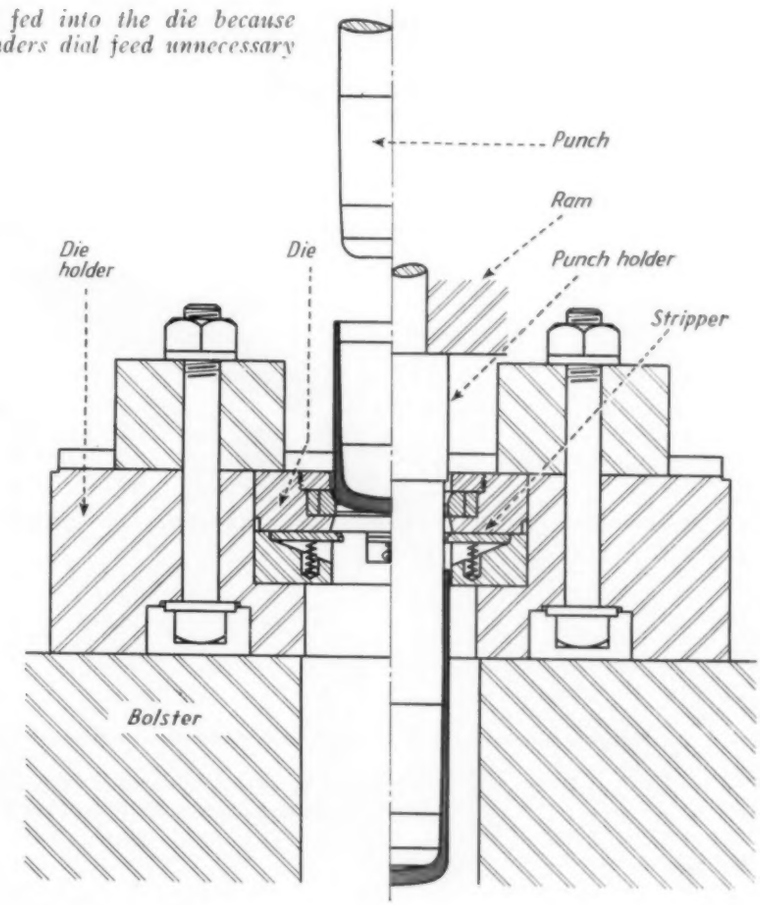


Fig. 9—*Dimensions of the 75-mm. case after the second redraw show reductions varying from 40 per cent at the bottom to 50 per cent at the top*



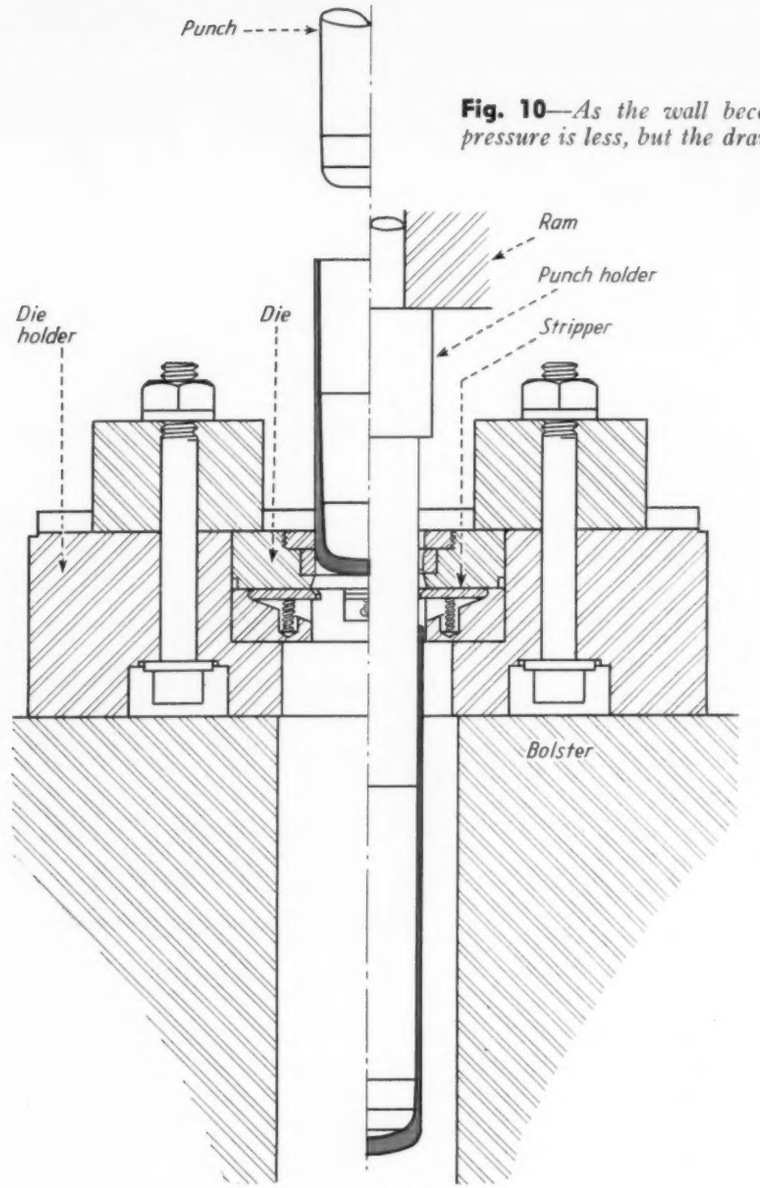


Fig. 10—*As the wall becomes thinner, the required pressure is less, but the drawing speed must be reduced*

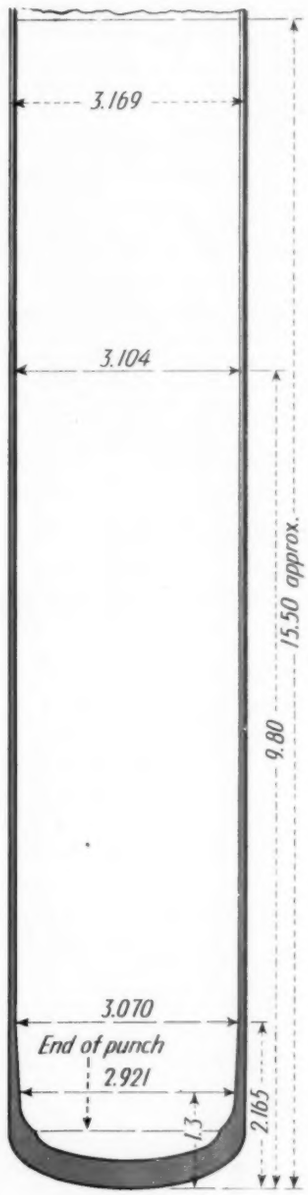


Fig. 11—*If the case is given proper press work, it will have a strength of 85,000 lb. per sq. in. after the third redraw*

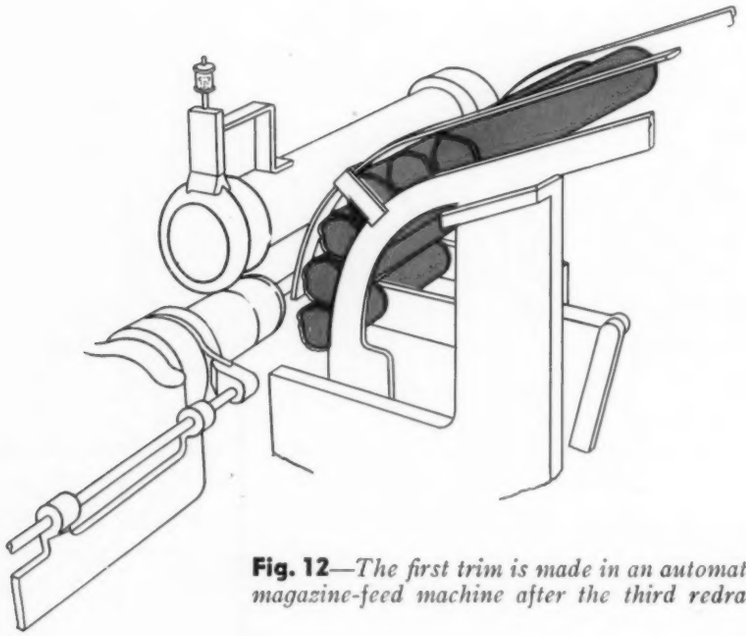


Fig. 12—*The first trim is made in an automatic magazine-feed machine after the third redraw*

per sq. in. tensile strength near the bottom of the side wall.

Before leaving the drawing operations, it might be well to mention that all the presses used are equipped with forced feed lubricant pumps with the exception of the cupping press where the disks are dipped by hand into the lubricant pan and placed into the bushings of the dial feed ready to be fed under the punch.

Carbide insert dies are used throughout because of the severe reduction and high production of the presses. This type of die requires less maintenance because the damage from brass pick-up and die wear is less.

After each drawing operation, the cases are washed in hot water in individual tanks at the presses to remove drawing compound and loaded into the annealing baskets. On the way to the furnace, they are again washed in a central washing tank containing hot water. This insures unspotted clean-finished cases.

Following the third redraw, the cases are ready for the first trim of the mouth end of the case. This operation is performed on an automatic end-trimming machine equipped with magazine feed as shown in Figs. 12 and 13.

After the cases are trimmed to the dimensions shown in Fig. 14, they are ready for the heading and indenting operation that is performed on a 1,000-ton hydraulic heading press equipped with a six-station dial feed. See Fig. 15. The base of the case is given a light coat of beef tallow or drawing compound paste to facilitate the spreading of the metal toward the outer edge while the pressure is being applied

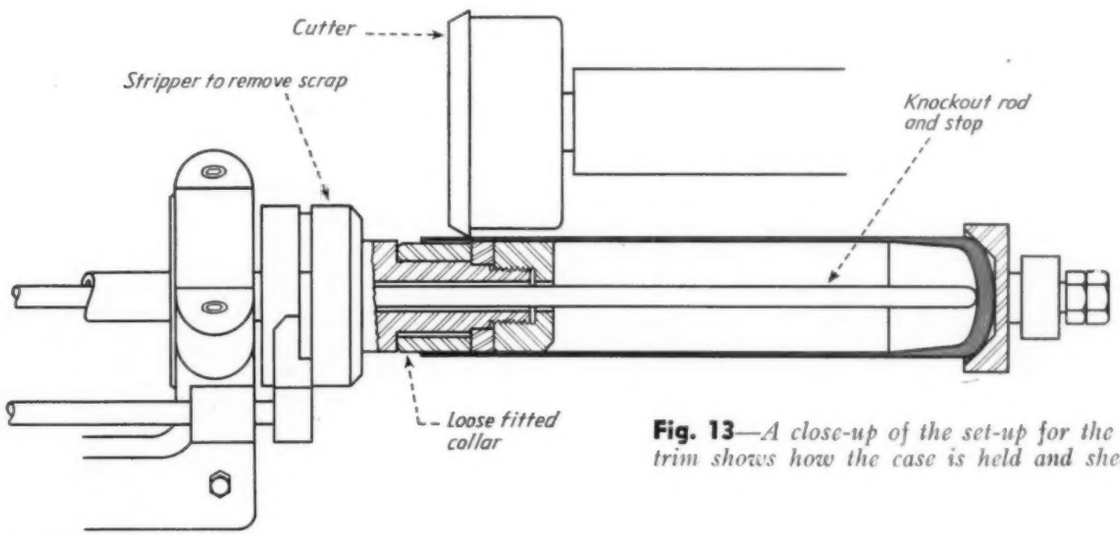


Fig. 13—*A close-up of the set-up for the first trim shows how the case is held and sheared*

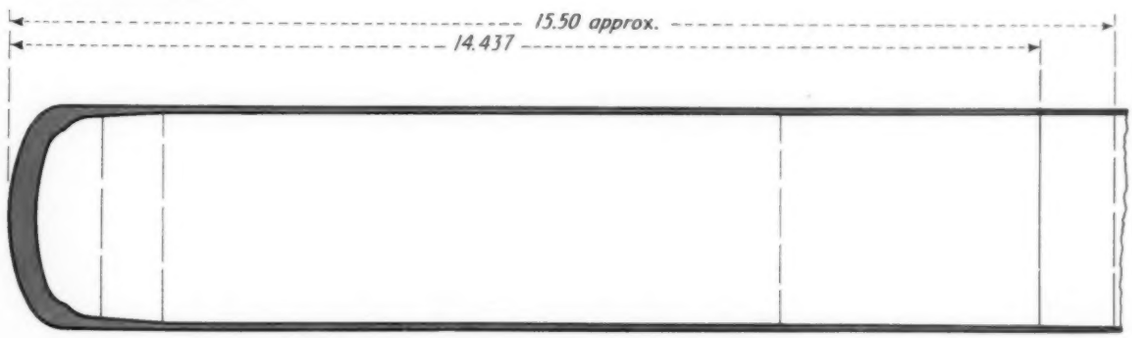


Fig. 14—*These are the trimming dimensions, which make the shell ready for the heading operation*

by a heading bumper having a ¾ deg. convex angle along its face.

The indenting of the primer hole is done to prevent expansion of the primer seat during service. This operation is performed in conjunction with the heading operation by inserting a plug into the primer boss cavity of the heading nose. The dimensions of this plug are 0.480 in. at the base and 0.310 in. in length, pointed to a $\frac{3}{32}$ in. radius at the point. This plug so displaces the metal as to give a Brinell hardness of 130 to 140 (using a 15-kg. load and $\frac{1}{16}$-in. steel ball) just beyond the walls of the finished primer hole.

After a case is headed by the bumper, which exerts a pressure of 675 tons, it is indexed to the unloading station and ejected as shown in Fig. 16. Care should be exercised during this operation to see that no cold shuts or folds are present on the inside radius of the case that might cause separation of the head from the side wall during service. Dimensions appear in Fig. 17.

Following this operation, the cases are ready for body annealing to help ease the tapering without caving in of the sidewall. The cases are placed in an annealing rack and submersed mouth down into molten salt-peter at a temperature of 950 F. to a depth of 9 in. They remain in this bath for 1¾ min.

Consequently, since no hole is provided for the escape of air as the cases are immersed in this bath, an air vent fixture was made as shown in Fig. 18.

Immediately upon completion of this anneal, the work is raised by an air hoist and plunged into a cold water bath in order to remove the molten salt-peter. The cases are finally rinsed in hot water

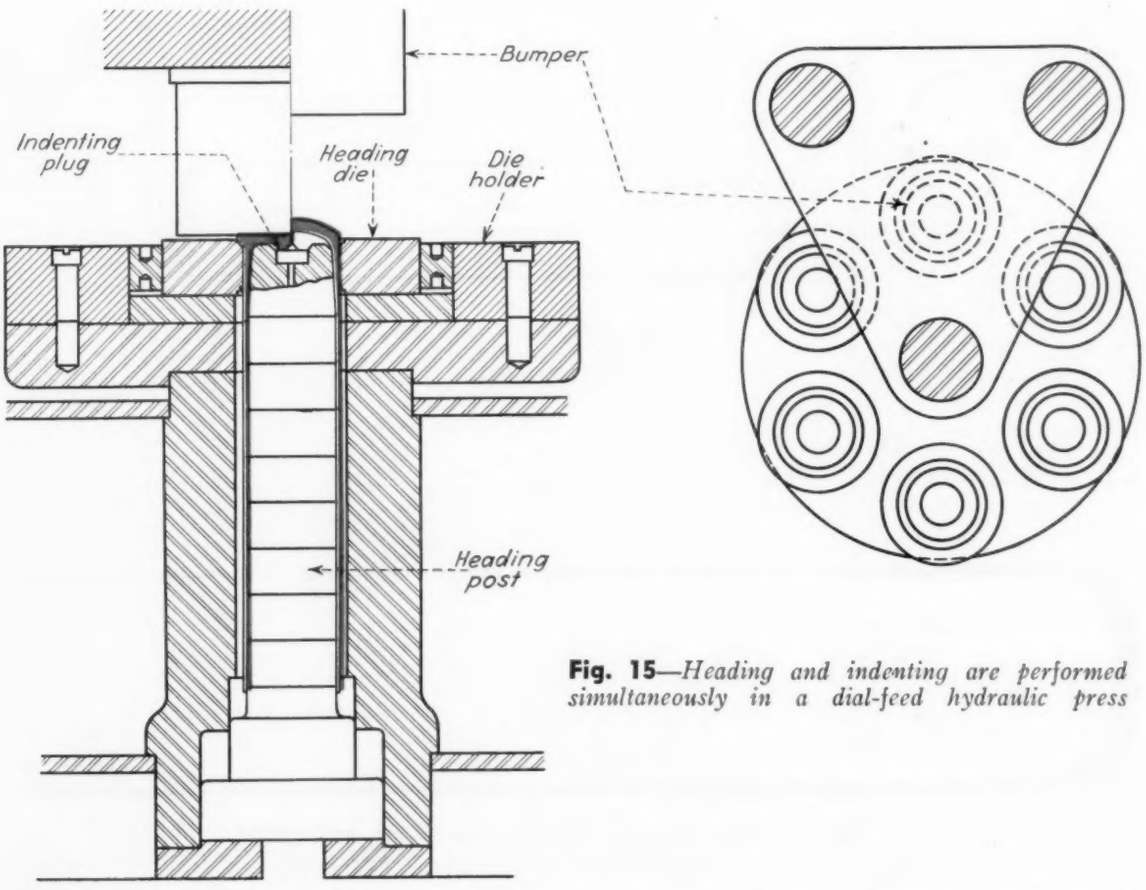


Fig. 15—*Heading and indenting are performed simultaneously in a dial-feed hydraulic press*

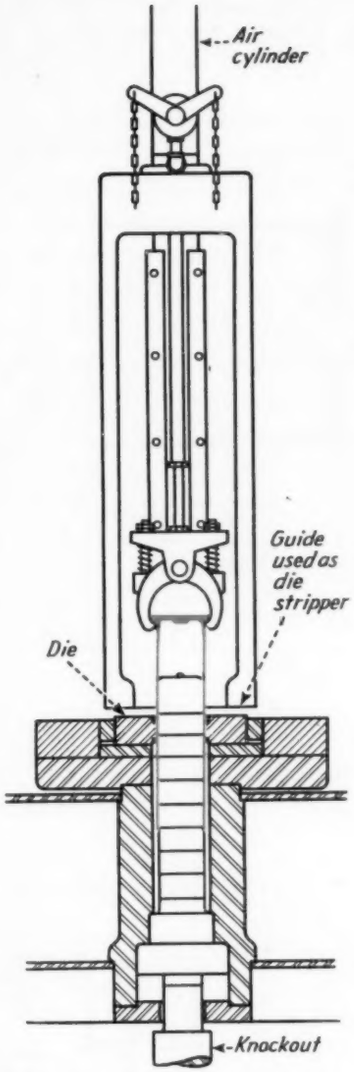


Fig. 16—*A pneumatically operated gripping device lifts the case from the heading die*

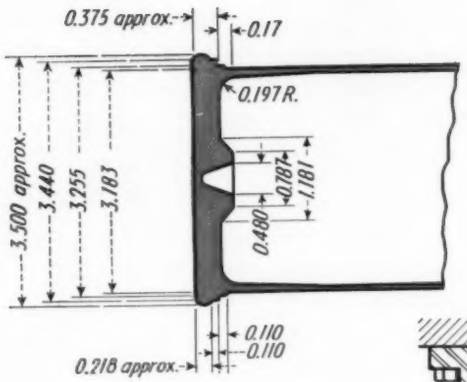


Fig. 17—*Dimensions of the head and indentation show how the accumulated metal is forced into its proper place*

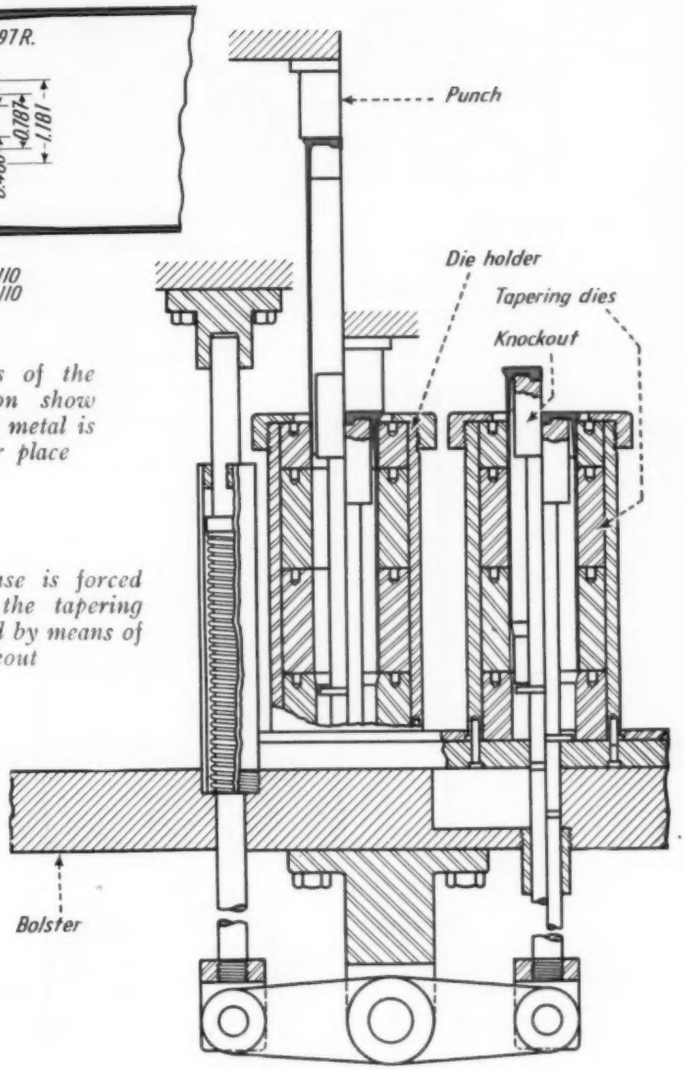


Fig. 19—*The case is forced downward into the tapering die and then freed by means of a knockout*

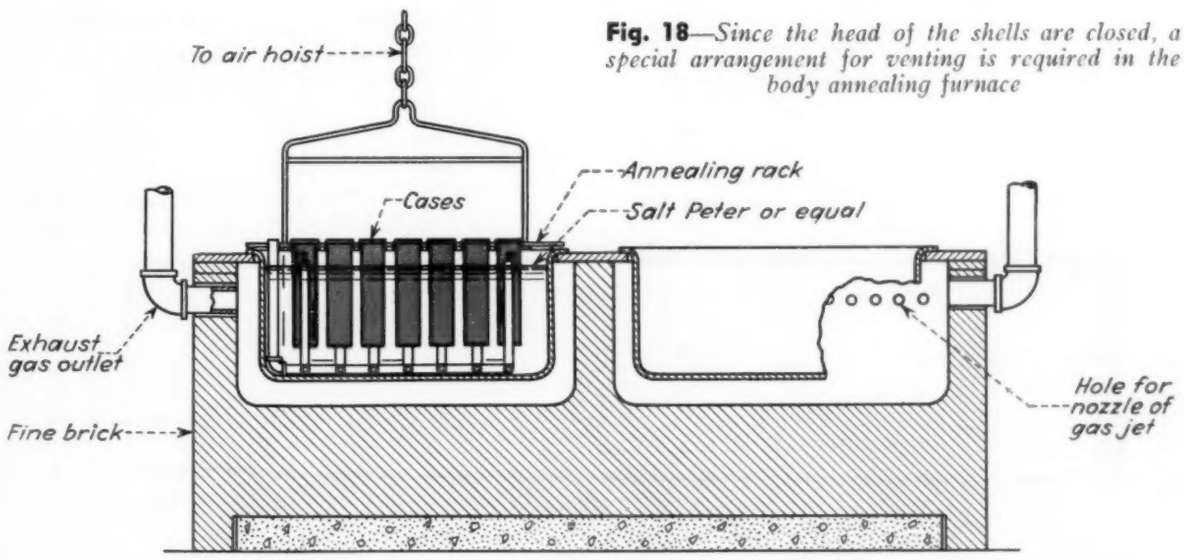


Fig. 18—*Since the head of the shells are closed, a special arrangement for venting is required in the body annealing furnace*

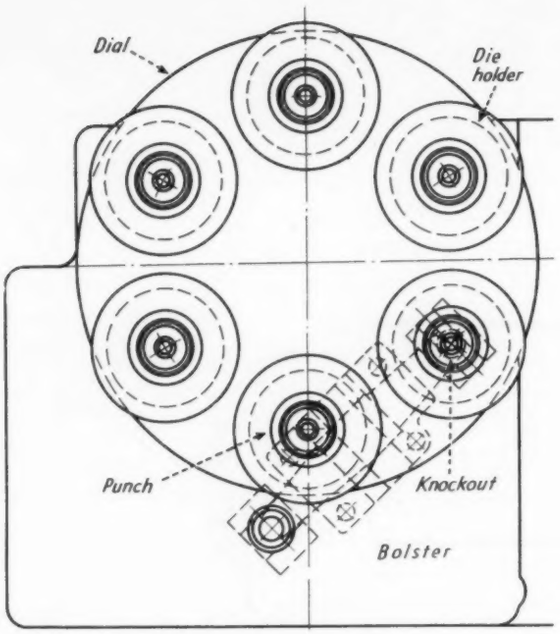


Fig. 20—*A plan view shows how the rocker arm extending from the work station to the ejector station operates the knockout*

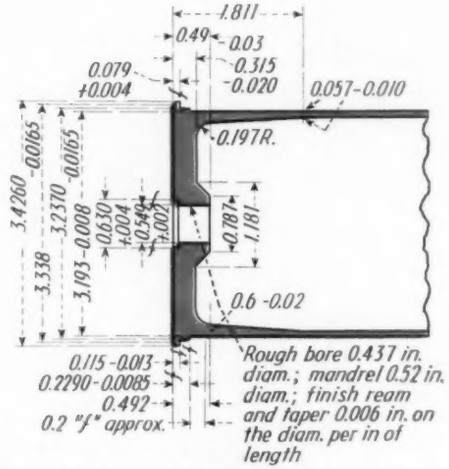


Fig. 23—*Head dimensions are more precise than any others in the case. The limits are as shown in the sketch*

Fig. 22—*Machining the head and primer hole is done in a four-spindle machine and includes drilling, rough and finish reaming*

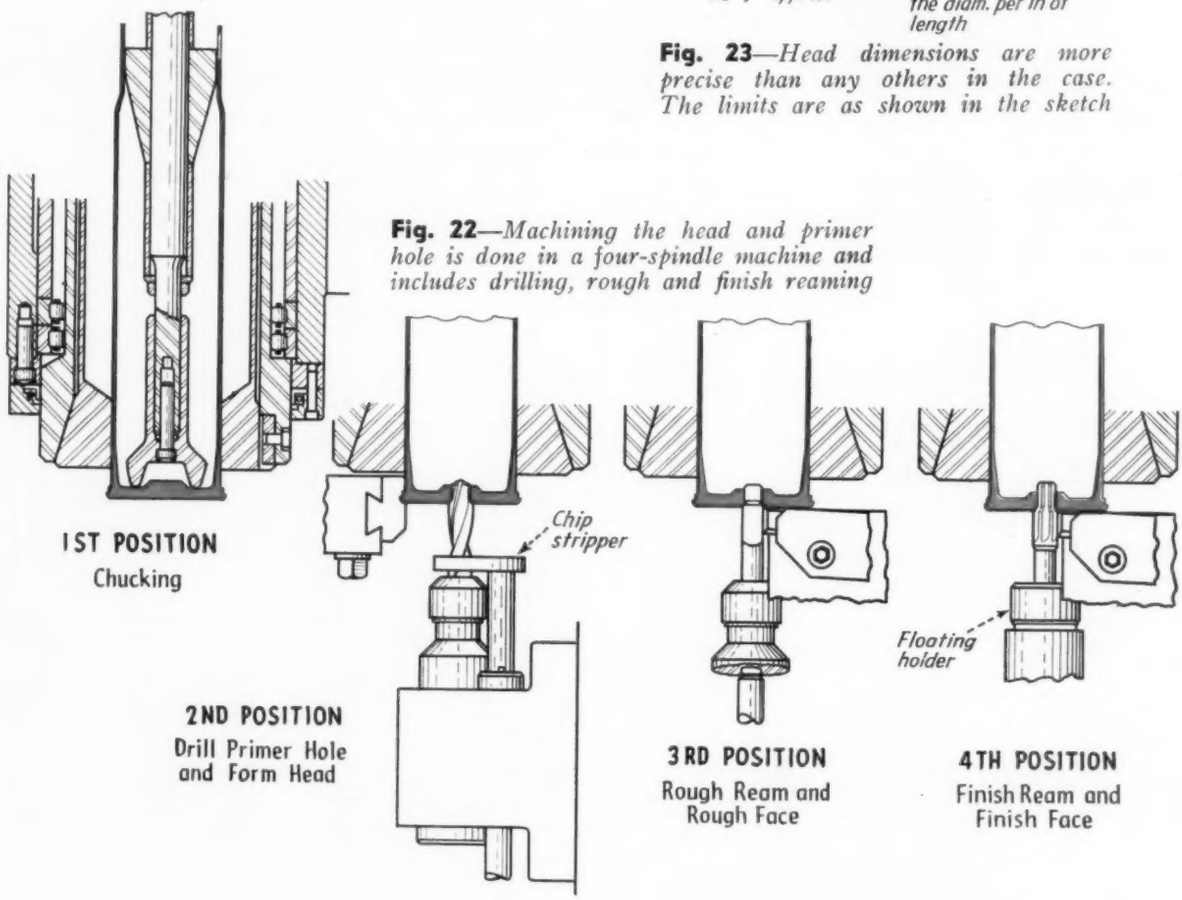
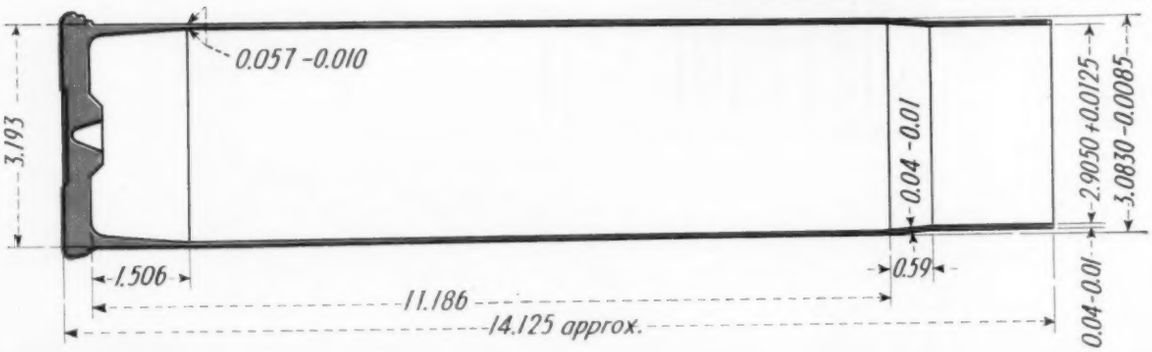


Fig. 21—*After the case has been tapered the dimensions are as shown below*



to aid drying prior to the tapering operation.

For the tapering operation, the side wall is lubricated with a combination of 25 per cent soluble and 75 per cent lard oil. Each case is then placed mouth down in the die of a six-station dial-feed mechanical press and fed under the bumper automatically. It is forced into the die as shown in Figs. 19 and 20 and tapered to final dimensions of the finished case (Fig. 21).

Each case is stripped from the die by a rocker arm at the bottom of the press extending from the work station to the ejecting station. This is also shown in Fig. 20.

This operation requires approximately 20 tons and a ram speed of approximately 60 ft. per min.

After they are tapered, the cases are ready for the final machining of the head and primer hole. This operation is done on a four-spindle horizontal chucking machine. The sequence of the machining operation is clearly shown in Fig. 22.

When the head and primer hole have been finish machined to dimensions shown in Fig. 23, the cases are trimmed at the mouth on a two-spindle drill press as shown in Fig. 24. The final trim size is 13.82-0.04 in over-all.

The cases are then washed in an alkaline cleaner to remove the grease and oil accumulated from tapering and machining operations. This is done to prevent unnecessary stains on the finished case when mouth annealed.

The final mouth anneal is carried on in the same manner as the anneal for taper

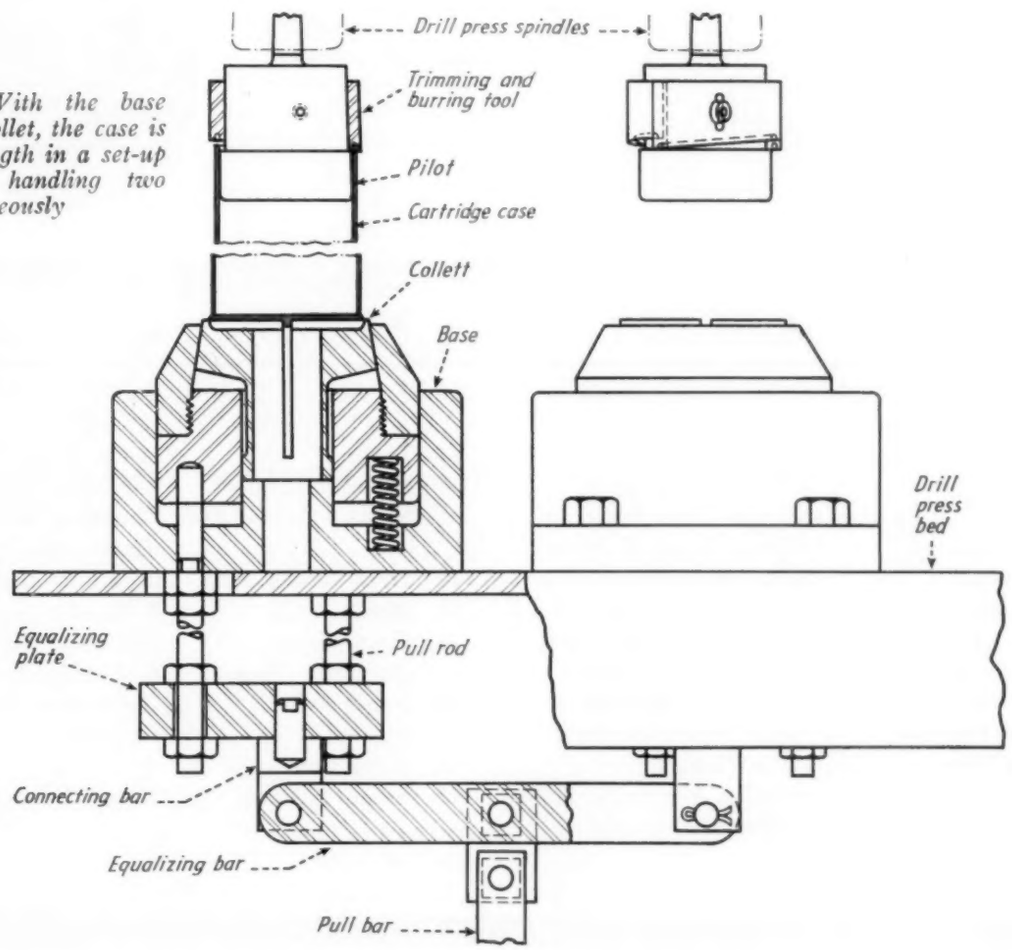


Fig. 24 — *With the base gripped in a collet, the case is trimmed to length in a set-up arranged for handling two pieces simultaneously*

with the exception that the cases are immersed at the mouth 2⅛ in. for 2½ minutes. The air vent is unnecessary as the cases have the primer hole in the head of the case. At the completion of this anneal they are submersed in the cold water tank, then in an alkaline cleaner and rinsed off in hot water to dry. The annealing operation is done to make the metal at the mouth ductile enough to prevent setting up excessive strains in the metal that will cause season cracking after the projectile is inserted and the complete round placed in storage.

Following this operation, the cases are ready for the stress relief anneal. A conveyor-type furnace is used for this operation, the cases being charged at one end and discharged at the other.

The cases are stored on trucks to be cooled and are then ready for inspection. At the completion of the inspection, they are stamped (Fig. 25) and packed, ready for shipment.

The views expressed in this article are solely those of the writer and in no way reflect the attitude of the War Department. The statements made and figures quoted are not from official sources.

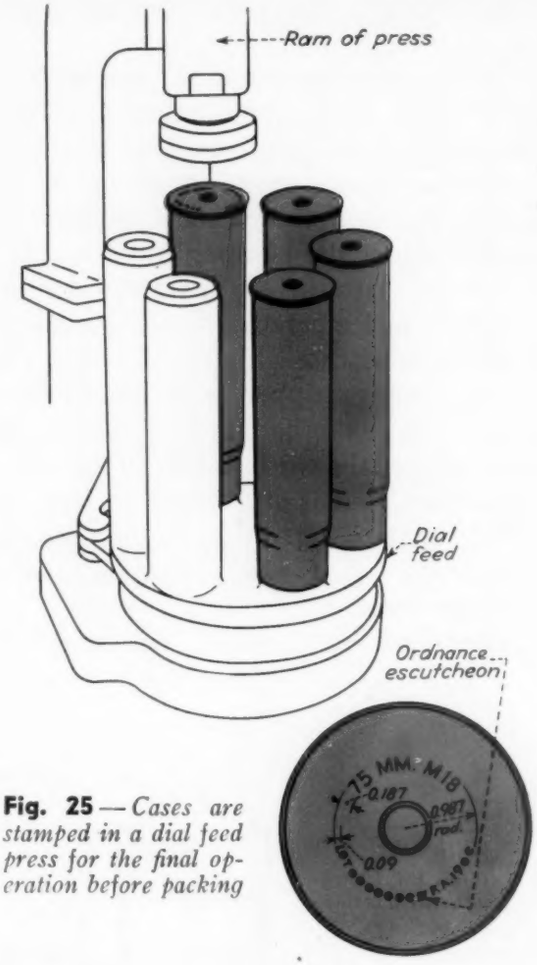


Fig. 25 — *Cases are stamped in a dial feed press for the final operation before packing*

No.	Operation	Machine Used	No.	Operation	Machine Used
1	Cupping	*250-ton Crank Press	13	Anneal for Taper	Salt Peter Furnace 2 Tanks
2	Anneal & Cool	Furnace			
3	Pickle & Wash	Pickling Basket 3 Wooden Tanks 1 Lead Lined Tank	14	Taper	*70-ton Crank Press
			15	Finish Machine Head & Primer Hole	4-Spindle Auto Chucking Lathe (Horizontal Type)
4	1st Redraw	*175-ton Crank K Press			
5	Anneal & Cool	Same as Operation No. 2	16	Final Mouth Trim	2 Spindle Drill Press
6	Pickle & Wash	Same as Operation No. 3	17	Wash	3 Wooden Tanks
7	2nd Redraw	150-ton Hydraulic Press	18	Final Mouth Anneal & Wash	Salt Peter Furnace 4 Wooden Tanks
8	Anneal & Cool	Same as Operation 2			
9	Pickle & Wash	Same as Operation 3	19	Stress Relief Anneal	Continuous Draw Furnace
10	3rd Redraw	75-ton Hydraulic Press			
11	1st Trim	Auto. Trimmer	20	Inspection	
12	Head and Indent	1000-Ton Hydraulic Press	21	Stamp & Pack	*70-ton Crank Press

** Tonnage Rating at bottom of stroke*

Correcting Machine Tool Lubricating Troubles

Courtesy of Socony-Vacuum Oil Company, Inc.

THE PROPER LUBRICATION for any given machine tool depends upon the duty involved and the method used for applying the grease or oil. However, any oil used must meet definite requirements of viscosity, ability to flow at low temperature, and resistance to breakdown in service. Body or viscosity must be sufficient to prevent metal-to-metal contact, but must not be so heavy as to cause high internal friction or to fail to penetrate the close clearance involved. Breakdown resistance must be sufficient to prevent decomposition or gumming under continuous service. It is also important that any oil used be free of impurities which might injure machine parts or oiling mechanism. Acid, for instance, will cause pitting of highly polished surfaces.

But troubles frequently occur which are traceable to the lubricant, method of applying it, or to the mechanical condition of parts of the machine tool. These troubles are listed below; each suggests its own remedy.

TROUBLES TRACEABLE TO LUBRICANT

1. Dirty container or lubricant contaminated
2. Lubricant does not have the proper physical characteristics
3. Lubricant is emulsified
4. Water in the bearing or reservoir
5. Mineral oil added to a compounded oil, or different compounded oils added to each other. (Fresh mineral oil added to a compounded oil containing blown vegetable oil has a tendency to sludge. Mixing different compounded oils together may also cause sludging)
7. Lubricant been too long in service

TROUBLES TRACEABLE TO METHOD OF APPLYING LUBRICANTS

1. Oiling devices and supply pipes not clean and choked
2. Lubricant not being fed in sufficient quantity
3. Oil level too low in a splash oiled bearing
4. In bearings requiring wool or silk packing lint from cotton waste or rags may have entered the bearing
5. Incorrect grooving and chamfering
6. Incorrect application of lubricant
7. Imperfect distribution of the lubricating film. Lubricant may have to be applied at more than one point on the bearing surface
8. Ring or chain in a ring or chain oiled bearing broken
9. Felt pads glazed or fallen from journal
10. Wicks have insufficient strands, or are not clean
11. Ball or roller bearings housings too full of lubricant

TROUBLES TRACEABLE TO MECHANICAL CONDITIONS

1. Change in the load conditions necessitates a change in the lubricant
2. Improper clearance between the journal and bearing (if too tight the lubricant can't get in, and if too loose the lubricant will not be retained)
3. Belt or rope drives too tight
4. Equipment out of alignment
5. Vibration due to unbalance
6. In brass bearings, lubricant escaping between the brass and housing. Brass warped
7. Bearing cracked or rough
8. Bearing cap loose or out of line.
9. Bearing of insufficient size to carry the load
10. Foundation of the equipment shifted
11. Bearing material excessively sensitive to temperature variations
12. Insufficient means of proper heat transfer from the bearing

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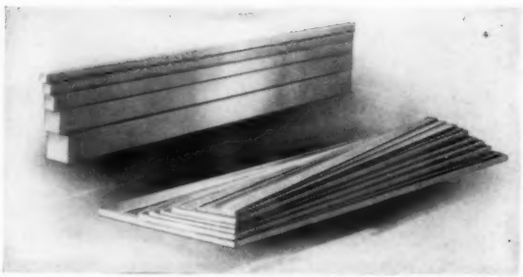

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Speeds and Feeds for Turret Lathes

Courtesy of Warner & Swasey Company

HARD AND FAST rules for turret lathe speeds and feeds cannot be set without exact information on the following items:

1 Type of machine used
2 Condition of the machine
3 Form of cutting tool
4 Brand of cutting tool
5 Method of mounting the tool
6 Analysis of the material to be cut
7 Method of holding the work
8 Type of cutting lubricant

However, speeds and feeds for different materials fall within definite ranges. Some of these are listed in the accompanying table for ram-type and saddle-type turret lathes, using high-speed steel, Stellite J, and carbide cutting tools. Obviously, they are for broad general use and subject to change with variables occurring in both tools and material.

The table is a guide when starting work on the materials listed. The operator should start his machine at or near the highest surface speeds and feeds given, and watch the cut for a few turns. The color of the chip and "feel" of the machine will determine whether the speed and feed are correct, or whether they should be increased or decreased. Experience shows that speed of cutting steel is nearly correct when the chip is of straw or light yellow color; should the chip be blue, it is too hot, and the speed or feed, or both, should be decreased. No speed or feed should be used that causes the lathe to vibrate.

Since the table gives cutting speed in surface feet per minute, the operator must set the rotational speed of the lathe spindle in accordance with the diameter of the work. Tables for converting surface feet per minute into revolutions per minute for various diameters are available in most handbooks. However, the conversion can be made by applying the formula

$$R = 3.8197\,S/d$$

where R = rotational speed, r.p.m., S = peripheral speed, surface ft. per min., d = diameter of work, in. Conversely, $S = 0.2617Rd$.

CONDENSED TABLE OF SPEEDS AND FEEDS FOR TURRET LATHES

	SURFACE FEET PER MINUTE						FEEDS			
	H. S. S.‡		Stellite J		Carbide		Ram-type machine		Saddle-type machine	
Material	*Rough*	*Finish*	*Rough*	*Finish*	*Rough*	*Finish*	*Rough*	*Finish*	*Rough*	*Finish*
Cast iron	50-60	80-110	90-120	130-160	180-200	350-400	0.016-0.025	0.016-0.025	0.032-0.060	0.032-0.125
Semi-steel hard	40-50	65-90	75-100	100-130	140-160	250-300	0.016-0.025	0.016-0.025	0.032-0.060	0.032-0.125
Malleable iron *	80-110	110-130	120-140	150-200	250-300	400-500	0.016-0.025	0.016-0.025	0.032-0.060	0.032-0.060
Steel casting (0.35 carbon) *	45-60	70-90	70-80	90-130	150-180	200-250	0.010-0.020	0.012-0.020	0.018-0.030	0.018-0.045
Brass (commercial 85-5-5)	200-300	200-300	.....	.....	600-1000	600-1000	*Maximum feed of machine*			
Bronze (80-10-10) *	110-150	150-180	.....	.....	600	1000	0.016-0.030	0.010-0.016	0.016-0.050	0.010-0.030
Aluminum **	400	700	.....	.....	800	1000	*Fine feeds to produce good finish*			
SAE 1020 * (Coarse feed)	60-80	60-80	.....	.....	300	300	0.020-0.030	0.020-0.030	0.024-0.044	0.024-0.044
(Fine feed)	100-120	100-120	.....	.....	450	450	0.007-0.020	0.007-0.020	0.010-0.030	0.010-0.030
SAE 1035 *	75-90	90-120	.....	.....	250	250	0.020-0.030	0.020-0.030	0.024-0.044	0.024-0.044
SAE-X-1315 *	175-200	175-200	.....	.....	400-500	400-500	0.010-0.015	0.010-0.015	0.010-0.015	0.010-0.015
SAE 1050 *	60-80	100	.....	.....	200	200	0.012-0.020	0.012-0.020	0.025-0.090	0.015-0.045
SAE 2315 *	90-110	90-110	.....	.....	300	300	0.012-0.020	0.012-0.020	0.025-0.090	0.015-0.045
SAE 3150 *	50-60	70-90	.....	.....	200	200	0.012-0.020	0.012-0.020	0.025-0.090	0.015-0.045
Stainless steel * (Selenium content)	100-120	100-120	.....	.....	240-300	240-300	0.010-0.015	0.010-0.015	0.010-0.015	0.010-0.015

‡ Water soluble oil lubricant. ** Kerosene lubricant. ‡ Cobalt 18-4-1.

OUTSTANDING IN PERFORMANCE

Entirely open end construction of NEW BRITAIN Chuckers adds greater productivity by providing for ease of loading and tool adjustment.

This feature, and many others for PERMANENT ACCURACY contribute to the outstanding performance of NEW BRITAIN Automatics.

NEW BRITAIN-GRIDLEY

MACHINE DIVISION • THE NEW BRITAIN MACHINE CO.
NEW BRITAIN, CONNECTICUT

MODEL **86**

Eight Spindles
6¾-inch chucks

A complete line of Chuckers — Four, Six and Eight Spindles to 10¼" Capacity
Also a complete line of Screw Machines—Four and Six Spindles to 2¼" Capacity

Keep Prices in Line

PRICES are under inspection as the defense program moves along. That fact should not cause surprise. It should be welcomed.

With billions being spent for armament, the American people want to be sure they are getting their money's worth. It would be extremely costly to have an upward spiraling of prices which probably would result in a crash such as occurred after the World War. Moreover, the public would resent anything that resembled profiteering at a time when manpower was being conscripted for national service. However you look at it, any general upswing of prices would be cause for alarm and would provoke public disapproval.

For those reasons industry has a grave responsibility for doing everything within its command to guard against major price advances. Yet it would be foolish to lay down the rule that all increases are outlawed. No doubt there are cases where materials costs, labor rates and design improvements make price advances imperative if the manufacturer is to earn a modest profit. It would be unfair and unfortunate if such cases were used as an excuse by unsympathetic interests to start a witch-hunt against industry. We don't believe responsible officials in Washington have any such intention.

So that no misunderstandings may arise we suggest that the proper authorities within the Defense Commission investigate each individual case of alleged excessive prices to get at the facts before they come to any conclusions. It is so easy to be misled.

Let's take a hypothetical case of a machine tool. Suppose the Navy is quoted a stated price which might be considerably higher than for the same general type of machine five years ago. Before one could say that the price advance was not justified, a certain set of questions should be answered.

Was the previous machine exactly like the one to be built? Does the new machine contain any added features of construction not possessed by the earlier machine, thus running up production and materials costs? What are the materials costs today compared with five years ago? Are labor rates up or down today as against then, and how much overtime pay is involved? What is the production guarantee of today's machine? Won't it turn out a lot more work than the machine of five years ago, and better work too? These are only a few of the questions which must be answered before one can say that prices are out of line.

While responsibility for careful investigation rests upon the government before making charges that manufacturers are "sticking" the army and navy, industry itself has the responsibility for seeing that the government is not stuck. Only irreparable harm can come to industry as a result of undue price increases. The Defense Commission has the power of overwhelming public opinion to use against any manufacturer who is so unwise as to violate the trust which is his today. It also can dig up good law to back up its stand. The manufacturer who flies in the face of these danger signals is no friend of industry. In fact, he is not even his own friend.

Burnham Finney

GAGING BUSINESS

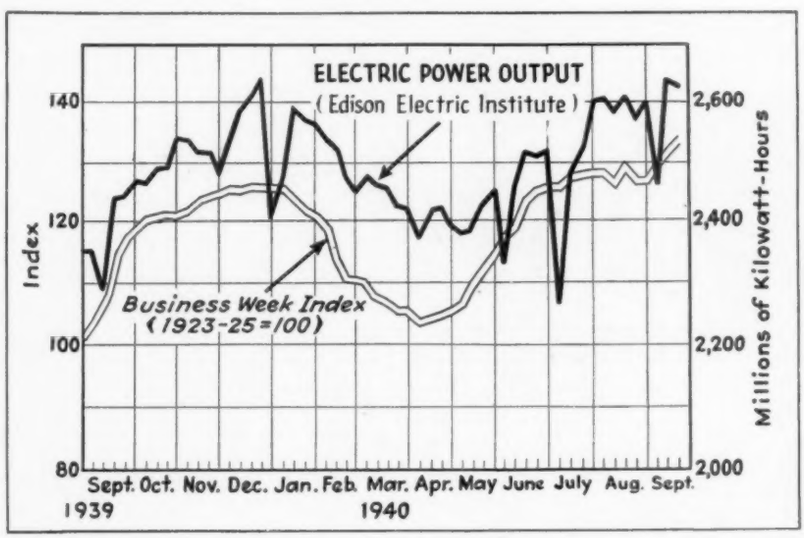
Defense orders, plus British and Canadian, call for machine tools totaling $750,000,000. Industry will be producing machines at rate of $500,000,000 annually before end of the year

Machine Tools—Defense orders for machine tools, based on the program already planned, with British and Canadian business added, will climb to an estimated total of $750,000,000. If the defense program is broadened further and the war should last several years, machine tools needed for armament purposes will far surpass that figure. Today machine tool builders are turning out equipment at a rate of about $450,000,000 a year and before the end of 1940 will have expanded production onto a basis of $500,000,000 annually. Machine tool bookings for munitions projects piled up during September in a volume far exceeding operating capacity, and deliveries now are strung out over the next year. The voluntary priority system put into effect on machine tools for armament work makes it almost impossible for the time being for a company fabricating peacetime products to secure new equipment. Machine tool builders themselves who need new machines badly to increase output required by companies with munitions contracts are being given preferential delivery over all others on authority from Washington. Hundreds of machine tools to which foreign governments (Japan, Russia, France, Netherlands East Indies) have title but which the Army and Navy refuse to allow exported are still on the docks at seaboard waiting for Congress to pass the necessary legislation so that they can be taken over by the government for defense purposes. Wright, Pratt & Whitney, Chrysler, Ford and General Motors are among the big purchasers of machine tools for armament manufacture.

Steel—Mill backlogs are so heavy that virtually full capacity operations will prevail for months ahead. No expansion of open-hearth facilities is believed necessary to meet defense requirements. A possible shortage in electric furnace steel capacity is currently being remedied by installation of additional furnaces. Alloy steel made by the electric furnace process will be particularly in demand for airplanes and armor plate. Republic Steel, now increasing its electric furnaces, expects to produce large tonnages of armor plate for tanks. Bar mills for production of shell forge stock may have an overload later on unless orders are reasonably spread out.

Aircraft—About 19,000 planes of all types will be produced in the U. S. in the 12 months which began July 1. In that same period around 25,000 engines will be built. When sufficient engine capacity is available, approximately five motors will be made for every two planes. Output of military planes, now estimated at 750 a month, should be up to 1,400 a month by next summer. Curtiss-Wright has received plane orders totaling $94,161,701 from the Army Air Corps. North American Aviation's recent awards from the War Department amount to $72,857,049. The industry's unfilled orders now are well over the two billion mark. Present program is for Britain to get pursuit ships first and the U. S. to take training planes second. Third in preference are said to be bombers for England. Plans for making nine-cylinder engines at Wright Aeronautical's new Cincinnati plant have been abandoned in favor of a 14-cylinder job. Allison is producing 200 motors a month now and will be up to more than 400 motors a month within the next 90 days.

Munitions—The War Department has contracted for over $1,000,000,000 of ordnance material the past 10 days, the armament program having been perceptibly speeded up. Of that total almost $250,000,000 went for ammunition and ammunition components and $75,688,245 for tanks. Pullman-Standard will build medium-weight tanks for the British and 2,306 mortars (81 mm.) for the U. S. at its Hammond, Ind., plant, which was a large producer of munitions during the World War. In addition to a contract for some 70,000 machine guns of various sizes, General Motors will manufacture shell on an important scale at Oldsmobile and Chevrolet. The War Department is asking companies with munitions contracts to provide air raid shelters for workers. The Department is considering storage of ammunition underground as a precautionary measure. Army arsenals have increased their output 30 per cent recently as a result of establishment of a 48-hour week. Packard Motor is tooling up more extensively for its 12-cylinder marine engine used for the Navy's so-called suicide speed boats. It now has orders for 267 and pending business includes 100 more for Britain, 30 for Canada and 81 for the navy. Production will be raised to two a day. American Car & Foundry is reported to have received an additional order for 12-in. shells for the British totaling $3,000,000.



TAKE ORDNANCE INVENTORY

WASHINGTON—The Army had 49,124 semi-automatic (Garand) rifles on hand August 1 and 191,435 on order. It also possessed 471 3-inch anti-aircraft guns and had 117 on order. The status of other ordnance material on hand of Aug. 1 is as follows: field artillery, 75-mm. guns 241 with 1,230 on order; 75-mm. Howitzers 90 with 302 on order; 155-mm. long range guns, 4 with 92 on order; combat vehicles, scout cars, 525 with 1,887 on order; light tanks, 67 with 1,515 on order; medium tanks, 18 with 1,290 on order. Tractors, light tractors, 108 with 42 on order; medium 298 with 252 on order; heavy, 140 with 640 on order.

Government Plants, Under Contract Or Assigned, Reach $300,000,000

WASHINGTON—To the program of government-owned arms and munitions plants was added recently an award to Stone & Webster to build a $10,900,000 TNT and DNT plant, to be operated by du Pont. Four shipyards received awards to build government-owned facilities totaling $12,950,000. These awards bring the volume of government plant under contract or assigned to about $300,000,000. About $700,000,000 are provided in the War Department and other agencies for munitions plant construction. Plans for committing the balance of the sum are being worked out, and negotiations are under way with prospective private operators.

Reported as imminent are contracts with General Motors and Chrysler for building plants to turn out anti-aircraft guns. The plants will cost about $7,000,000 each.

Government-sponsored munitions plants are coming through under various financial arrangements which cannot be detailed in this space; about the only common denominator is that they are all to be privately operated. No breakdown is available as to proportionate cost of equipment and buildings, but it is safe to say the machinery is by far the major portion.

Other major government plant contracts are as follows: Savage Arms, Utica, N. Y., machine gun, $17,600,000; General Motors, Saginaw, Mich., machine gun, $20,000,000; Chrysler Corp., Detroit, tanks, $25,000,000; Carnegie-Illinois Steel Co., Pittsburgh, Navy guns, $2,275,000. The following firms will build shipbuilding plants: Consolidated Steel Co., Orange, Texas, $4,600,000; Seattle-Tacoma Shipbuilding, Seattle, $4,600,000; Manitowoc Shipbuilding Manitowoc, Wis., $1,000,000; Electric Boat Co., Groton, Conn., $2,750,000.

Manufacturers Must Give Preference To Army And Navy Orders Or Suffer Heavy Penalty

WASHINGTON—Conscription of industry, as finally passed, turns out to be, not bolshevism, but authorization for priorities. What the famous Section 9 of the Draft bill does is put teeth into the power granted the President last June to give Army and Navy orders first call. It states that manufacturers must give preference to Army and Navy orders, at a price which the two departments consider reasonable, under penalty of having responsible officers go to jail for three years, paying a $50,000 fine, and seeing the plant taken over by the government at a "fair and just" rental.

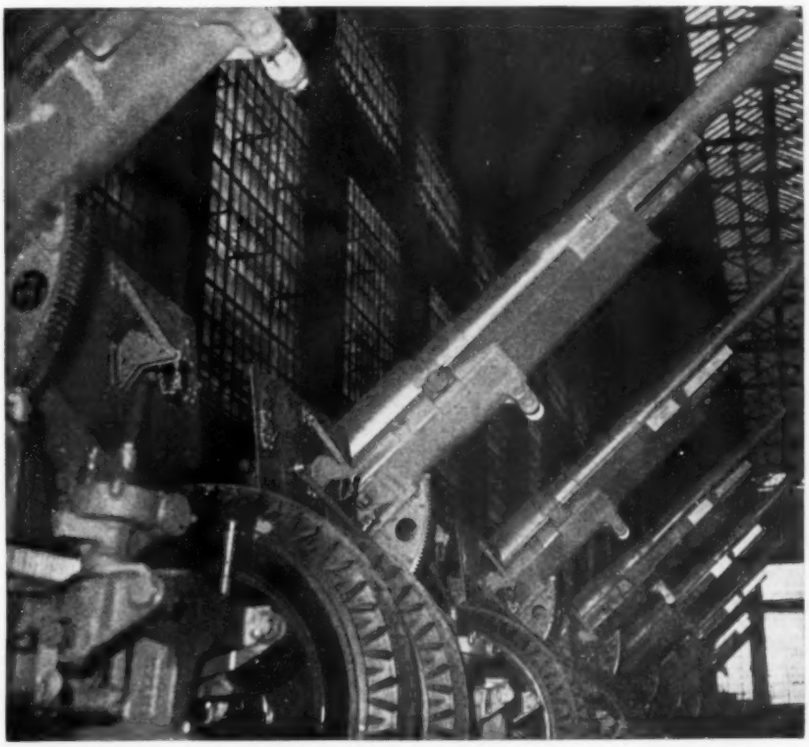
Navy was much impressed by this grant of power. Without consulting the defense commission it rushed out with a statement that it expected "to conscript those materials or commodities under contract for delivery to non-essential purposes. The conscription . . . will relieve the owners from prior contractual commitments."

This is an interesting example of the friction still existing between the services and the defense commission, but it is probably not a particularly illuminating indication of future policy. The commission has been building up its voluntary priority system, and has hopes that it can remain voluntary. The commission does want additional authority. But what is wanted is not teeth in the present preference for military contracts. The real problem now is to find a legal basis by which a sub-contractor can be told to give preference to orders from a prime defense contractor without involving the subcontractor in court battles with his less favored customers. The conscription bill offers no solution.

If the defense commission is unable to find some legal precedents for preference ratings on sub-contracts, it is probable that additional legislation will be sought.

FEW FACTORY WORKERS IN DRAFT

WASHINGTON—Not many factory workers will be drafted immediately. Only 2.5 per cent of men within draft ages will be called at first and only a small percentage of them will be from factories. For example, in a city of 100,000 the first draft will take about 40 men. If they are married they probably will be exempt anyway.



Ready For Service—*Are these modern 75 mm. field guns which have been manufactured at the government's Rock Island Arsenal. After final inspection in the assembly plant the guns are primed for possible action in the U. S. Army maneuvers*

Army Expansion Program Benefits Every Community; Orders Are Widely Distributed

NEW YORK—The industrial benefits of the Army's expansion program are reaching down into every American community. Protests from midwestern towns to the contrary notwithstanding, these communities, too, are reaping their share of the work and contributing their proportion of the raw materials. An order to an industrial concern in Hartford or Seattle seldom means that the work will be done in that particular city. On the contrary, it is more than likely that only a fraction will be done locally. Nor does it mean that management will derive the greatest gains. Statistics from typical organizations in the aviation industry tend to prove that labor, raw materials, and engineering costs take up the largest part of the aviation dollar.

These conclusions have been reached after a study of two typical organizations in the aviation industry—the large Boeing Aircraft Company in Seattle, which on August 30 received a War Department contract for 277 of its famous heavy bombing airplanes, the Flying Fortress, costing $70,449,955.20; and the Beech Aircraft Corporation, of Wichita, Kansas, which was given an award on August 28, 1940, for 150 training airplanes and 20 transport airplanes at a cost of $4,847,217.25.

Some observers indicate that the size of the corporation merely affects the extent of the job done in places other than the parent home of the company. The distribution is practically the same.

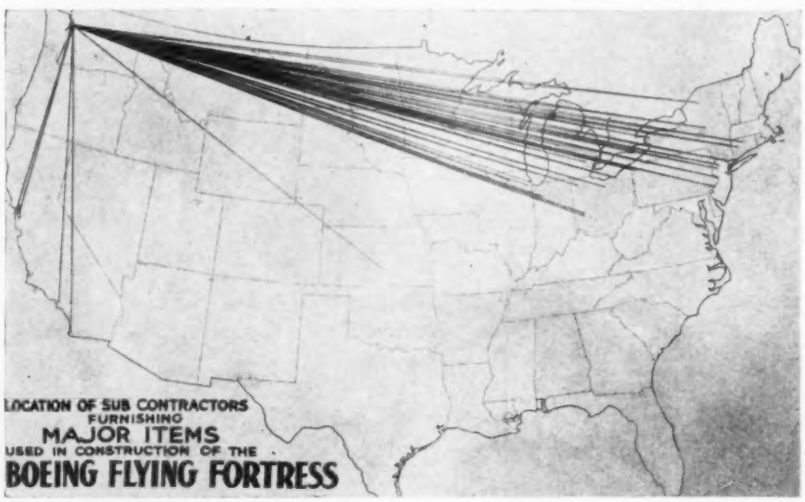
In a consideration of several features connected with the construction of the Boeing Flying Fortress, it is seen that the geographical sources of raw material used in its construction extend from Seattle to practically every state in the Union. The list of subconstractors and their addresses illustrates the same trend, for it indicates that plants everywhere are being mobilized to meet America's military needs in the industrial field.

Money Widely Distributed

The manufacturer's distribution of money received for aircraft during 1939 by the Beech Aircraft Corporation is especially instructive. The plant had a gross income of $1,300,000, yet the stockholders received nothing. The power plant builders got 20 percent, labor 16½ percent, engineering 10 percent, raw materials 7 percent—everyone profited but those who made the investment.

The national distribution of funds received in buying finished and raw material on the $619,000 spent by the Beech Aircraft Corporation in 1939, shows that 14 states in addition to Kansas contributed toward completing the Beechcraft model.

The division of labor and wages paid during the year point out the different types of employment called for in aircraft production. This Beechcraft job called for aircraft assemblying mechanics, engine mechanics, sheet metal workers, machinists, tool and die makers, painters, upholsterers, maintenance men, woodworkers, welders, and others. The mere mention of the trades also emphasizes the quality of skilled work demanded of aviation workers.



Coast to Coast—*A result of the Army's expansion program has been the coast to coast placement of orders in many and diverse industries. Above, most of the sub-contractors furnishing the major items in the defense schedule are, however, in Northeastern U.S.*

Military Supplies Can Be Provided By The Farm Equipment Industry

MILWAUKEE—The farm equipment industry is ready to contribute to national defense due to its many improvements in mechanization since World War I, is the indication presented recently at the Seventh Annual Meeting of the Tractor Division, Society of Automotive Engineers. Manufacturers of power farming machinery can provide military supplies in addition to normal products. Arthur Nutt, vice-president Wright Aeronautical Corp. and president of the SAE, emphasized the need for industrial preparedness beyond all other factors. A. Herrington, president, Marmon-Herrington Corp., also emphasized the need for preparedness and indicated that plants should be camouflaged and duplicates should be provided in case of destruction of the one in operation.

Many Export-Import Bank Loans Tied to Metal-Working Industry

WASHINGTON — Hitler started throwing his weight around Europe in the early '30s; the Export-Import Bank of the United States started making loans to South American countries in 1934—to save the Latins from going totalitarian under such trade tricks as aski marks.

President Roosevelt signed the bill which increased the Export-Import Bank's present $200,000,000 revolving fund to $700,000,000, and authorizes the RFC to borrow an additional $1,000,000,000 to help finance the U. S. defense program. The only direct relationship between these two authorizations is that the Bank is a branch of RFC.

A list of commitments by the Bank to Hispanic countries from Feb. 12, 1934 to June 30, 1940, was spread on the record at Congressional hearings. It reads like a catalog of the metal-working industry: oil refining equipment, locomotives, cotton gins, machine tools, freight cars, road machinery, steel rails, equipment for steel mills, stokers, farm machinery, pipe, shoe machinery, pumps, motors, etc., etc.

During those years the Bank authorized a total of $436,900,000; $119,000,000 of that was canceled, and actual disbursements were only $162,000,000. Either a Latin government, or an American company negotiating a sale south of the border can approach the Bank for a loan. In nearly all cases of loss, the Bank takes it, not the exporting company. Jesse Jones, Federal Loan Administrator, testified that the United States can have no protection against losses due to repudiations or uprisings. But he said the losses would be well justified.

New Attempt to Organize Ford Begins Under CIO Leadership; $100,000 in War Chest

DETROIT—The United Auto Workers drive to organize Ford was given a new lease on life when Michael Widman, assistant to CIO vice-president Allen Haywood, moved last week into the union's outpost on Michigan Ave., just outside Dearborn. Widman will report jointly to R. J. Thomas of the UAW and John L. Lewis of the CIO. These groups are contributing $50,000 apiece to a $100,000 war chest. The money will be devoted to organization efforts at Ford, in the Chicago district and in the aircraft and farm implement industries. While possibly more skilled personnel is to be used in the new Ford drive, the scope of the planned activities as compared with the money available would indicate that an "all-out" attempt to unionize Rouge workers is not contemplated.

Because of the growing importance of the aviation industry in the Middle West, Walter Smethurst, another Haywood assistant, will make his drive headquarters at the UAW national offices in Detroit. His activities will include attempts to organize the Stinson plant at Nashville, Tenn., and the Wayne, Mich., plant, when the latter re-opens soon with 1,000 employees. Continental at Muskegon, also its Detroit plant when that is reopened, Packard's Rolls-Royce plant when under way, and the aircraft parts plants are other targets. The UAW sees 100,000 additional members in the aircraft industry and 50,000 in the aircraft-parts industry as the prizes to be won.

To finance its part of the deal with the CIO, the UAW is taking a referendum vote upon a $1 special assessment. A move to raise dues failed. While more militant than the United Rubber Workers, the UAW may find that the $1 assessment will be hard to collect, even if voted. In the recent annual convention of the Rubber Workers it was conclusively demonstrated that CIO union members will not pay monthly dues of more than $1 to support programs of their international officers, that voluntary contributions cannot be counted upon to sustain organization efforts, and that union members receiving the highest scale in the industry begrudge an extra 25 cents per month and refuse to do anything substantial about organizing their lower-paid competition.

U. S. Government Contracts Awarded to Metal-Working Firms

(Other contracts on page 774j)

Contractor	Gov't Agency	Commodity	Amount
Carnegie-Illinois Steel Corp., Wash. D. C.	Navy	Steel forgings	$213,775
Henry Disston & Sons Inc., Philadelphia, Pa.	War	Armor plate	68,006
Midvale Co., Philadelphia, Pa.	War	Tube forgings	101,080
Struthers Wells-Titusville Corp., Titusville, Pa.	War	Forgings	407,075
York Safe & Lock Co., York, Pa	War	Guns	719,198
Pressed Steel Car Co. Inc., Pittsburgh, Pa.	War	Forgings	119,832
American Locomotive Co., New York, N. Y.	War	Forgings	118,800
Pennsylvania Forge Corp., Philadelphia, Pa.	War	Forgings	76,250
Struthers Wells-Titusville Corp., Titusville, Pa.	Navy	Shafts	82,362
Scovill Mfg. Co., Waterbury, Conn	War	Body forgings	47,575
Harvey Metal Corp., Chicago, Ill.	War	Body forgings	90,930
McCauley Steel Propeller Co., Dayton, Ohio	War	Propeller blades	82,350
Bell Aircraft Corporation, Buffalo, N. Y.	War	Pursuit planes	19,896,668
Republic Aviation Corp., Farmingdale, Long Island, N. Y.	War	Pursuit planes	56,499,924
Packard Motor Co., Detroit, Mich	War	Engines	62,448,000
Glenn L. Martin Company, Baltimore, Md.	War	Bombers	14,269,646
Boeing Airplane Company, Stearman Aircraft Division, Wichita, Kansas	War	Training planes	6,934,096
Boeing Aircraft Company, Seattle, Washington	War	Bombers	59,762,850
Lockheed Aircraft Corp., Burbank, California	War	Pursuit planes	15,646,450
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn	War	Infantry weapons	2,796,056
Pullman-Standard Car Mfg. Co., Hammond, Ind	War	Infantry weapons	838,150
General Electric Co., Erie, Pa.	War	Artillery	1,759,826
York Safe & Lock Co., York, Pa	War	Artillery	2,914,720
National Pneumatic Co., Rahway, N. J.	War	Artillery	5,763,753
Midvale Company, Nicetown, Pa.	War	Artillery	1,260,308
Wheland Company, Chattanooga, Tenn	War	Artillery	1,500,000
Miller Printing Machine Co., Pittsburgh, Pa.	War	Infantry weapons	503,727
Mesta Machine Co., Pittsburgh, Pa.	War	Artillery	8,390,000
Continental Motors Corp., Muskegon, Mich.	War	Engines	11,412,000
Guiberson Diesel Engine Co., Chicago, Ill.	War	Engines	2,915,095
Wright Aeronautical Corporation, Paterson, N. J.	War	Airplane engines	6,829,144
Beech Aircraft Corp., Wichita, Kansas	War	Training planes	13,115,138
Harvey Metal Products Corp., Chicago, Ill.	War	Ammunition components	145,800
Pennsylvania Forge Corp., Philadelphia, Pa.	War	Artillery	109,025
Acme Machinery Co., Cleveland, Ohio	War	Forging machines	27,384
Crucible Steel Co. of America, Harrison, N. J.	War	Artillery	102,885
Oil Well Supply Co., Imperial Works, Oil City, Pa.	War	Ammunition components	246,262
Delco Products Div. of Gen. Motors Corp., Dayton, O.	War	Ammunition components	110,114
Rheem Manufacturing Co., Chicago, Ill.	War	Ammunition components	326,541
Mack Molding Co., Inc., Wayne, N. J.	War	Ammunition components	121,371
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn	War	Rifling machines	102,150

Newly Created Defense Plant Corp. To Provide Machinery for Packard

WASHINGTON—Providing machinery with which Packard can build Rolls Royce airplane engines is the first job assigned to RFC's Defense Plant Corp. This corporation was formed to care for the case of defense plant which the Army or Navy doesn't want to own and where, through fear of complications, the manufacturer doesn't want to take an RFC loan. In such a case the Defense Plant Corp. will borrow money from RFC, itself provide the needed machinery, and rent it to the manufacturer. Details on the Packard deal have not yet been made public, but apparently the Defense Plant Corp. came into the picture because of the complications of joint U.S.-British financing. The arrangement at present is that Britain is providing two-thirds of the machinery, the Defense Plant Corp. one third, and Packard is using its own buildings exclusively.

Training Planes For U. S., Pursuit Ships For England, Is Schedule

WASHINGTON — Commissioner Knudsen's statement that the British will get 40% of our aircraft output over the next 18 months is doubtless accurate, but it can be somewhat misleading. It fails to take into account the vital distinction between combat and training planes, and doesn't say whether it is the first 40% or the last 40% that goes abroad. Actually it is well understood in the aircraft industry that the general order of precedence is about as follows: First, pursuit planes for Britain because the big job now is to chase away Heinkels; second, training planes for the U. S., so that when we take delivery on fighting ships we'll have pilots to fly them; third, bombers for Britain, for the still hoped for day when a major offensive can be undertaken against Hitler.

The niggling attitude which has characterized British procurement ever since war's outbreak is finally beginning to be liberalized. Contracts are now being signed containing no quantities but agreeing instead to take the full output of whatever portion of the plant's capacity is allocated to export by the defense commission. However, only a few weeks ago at least one major manufacturer had an assembly line toiled up to produce 100 combat ships a month which had been standing idle for nearly three months while financial and technical details were worked out on the next order.

The whole question of capacity allocation between export and domestic demand is, of course, vital to munitions manufacturers.

British Combine

Hurryin' The Hurricanes—*Somewhere in the western part of England workers are busy building Hurricane fighter planes for the Royal Air Force. Production continues ceaselessly in an effort to attain mass proportions. Above is one of the shops where Hurricanes are produced*

Japanese Machine Tool Producers Compelled To Follow Government Dictates on Defense

TOKYO—The National General Mobilization Law, recently passed by the Diet, has been invoked to compel machine tool manufacturers to follow the government's lead and build those tools which are indicated to be essential for national defense. If this procedure should inflict losses on the manufacturers, compensation is provided. The tools specified in the regulation have been mostly imported from the U. S. and are now subject to the American export licensing order.

Importers have disclosed that the decreased shipments of machine tools and scrap steel from the U. S. have only mildly affected the Japanese industry. The real difficulty lies in Japan's own economic backyard. Japan's international balance of payments has failed to improve, and import permits are increasingly difficult to obtain. At present there is a growing backlog of applications awaiting authorization.

Imports of machine tools for the first half of 1940 were estimated at $18,565,000 as compared with $21,385,000 for the corresponding period of last year. If the depreciation of Japanese currency and the increasing cost of machine tools in the U. S. is considered, the true dimensions of the decline in Japanese imports become more apparent.

Since the outbreak of the European war the exports of machinery and machine tools have increased. Shipments during the first half of 1940 were valued at $52,875,000 as compared with $39,480,000 and $26,085,000 for the corresponding periods of 1939 and 1938.

Exports during the first six months of this year included 3,482 automobiles and chassis, 184 locomotives, 22 steamships, and 4,500 tons of metal-working machinery. Shipments of metal-working machinery recorded a decline from last year.

FAKE INSPECTORS AT PLANTS

PHILADELPHIA — Manufacturers doing business with the Army Quartermaster Depot are warned to be on their guard against unauthorized persons seeking to inspect their plants. Major Vere Painter, officer in charge of inspection, said that he had received information that certain unauthorized persons sought to enter factories engaged in the manufacture of commodities for the Army and for the "purpose of making an inspection for the Army Quartermaster Depot." There is no question but that the men were using fake credentials indicates Major Painter.

October Automobile Production May Surpass 450,000 Units

DETROIT—Now past the hurdle of production "bugs," major auto plants are reaching full stride in the race to meet consumer demand for 1941 models. Independents, too, have lifted the assembly rate, being joined by Nash and Willys. At the New York Auto Show, the latter will make first public announcement of the "Americar," new name for its revised line that will feature a larger body but continue the four-cylinder motor.

Official passenger and truck production in September will not be reported for several days, but the industry generally has swung into volume production so fast that earlier estimates must be revised upward to approximately 300,000 for the month. Thus, output surpassed that of Sept. 1939 by at least 56 per cent.

Cheered on by market possibilities and initial reception to new models, auto makers are scheduling near-capacity production for October. At this point output is estimated at between 450,000-475,000 units, with the top limit more likely. There is no reason to believe now that this fast pace cannot be maintained into December. Percentagewise, fragmentary sales reports for the first few weeks of September look favorable, but a better line on the strength of the retail market during fall months can be obtained only from sales reports.

Cadillac Invades The Medium Priced Field; Drops La Salle

DETROIT—Introduction of a new Series 61 at a base price of $1,345 and lowering the price of the Series 62 to $1,420 constitutes Cadillac's bid for a share of the growing market for medium-priced automobiles. Last year's "cheapest" Cadillac cost $1,685. Six lines are introduced for 1941, and all will be powered with an improved 150 hp. engine and be trimmed by Fleetwood. The LaSalle has been dropped. Present owners have been advised that complete parts and service facilities will be maintained.

Three of the six series are new—the 61, the 63 starting at $1,695 and the 67 starting at $2,595. The new 61 has the same wheelbase as the displaced LaSalle, 126 in., but its engine will develop 25 more horsepower, the body shell is new, and general treatment is in the Cadillac tradition. All Cadillac hoods have been revised to eliminate the hood side panel, the low broad hood now resting on fender "bridges". Front-end treatment is new and massive. Nickolas Dreystadt, Cadillac general manager, asserts that building of Allison parts has not and will not interfere with automobile production, because plenty of floor-space and workmen are available.

WATCHING WASHINGTON

"Bankable contract" is expected to cover most of the plant expansion. This method will bring in private capital and conserve RFC funds. $558,959,990 lent by RFC in three months

By BLAINE STUBBLEFIELD

WASHINGTON—A variety of procedures is being worked out to meet the several types of plant expansion necessitated by the defense program, and it becomes increasingly clear that no armament manufacturer is going to have to risk losing any of his capital—unless he is a natural gambler and deliberately chooses to take the risk.

The so-called "bankable contract" is growing in importance. Originally conceived simply as an intermediate step between private and government financing to meet certain special cases, it has now assumed a dominant position in defense commission thinking. Men in key defense jobs think nearly all defense plant expansion will take this form.

Basis of the plan is that, if the armament race lasts five years, the government is going to pay for privately financed plant expansion anyway because the price of the arms it buys will contain a plant item. The bankable contract is supposed to ensure that if the boom folds, the manufacturer won't have to take the loss—and if the boom lasts the manufacturer won't get a free plant with which to discomfit his competitors.

This is accomplished by separating an arms purchase transaction into two contracts. One specifies that the manufacturer will deliver over, say, the next two years, a specified quantity of goods at a price containing no item for the necessary plant. The second contract provides that the manufacturer will build a plant, and that the government will pay him the cost of the plant in five annual installments, the government assuming title when it has completed the payments. The manufacturer can then assign his rights under contract number two to a bank as security for a loan with the proceeds of which he will build the plant.

During the five years, the manufacturer in his tax statements enters the payments from the government as income and on the other side charges off an identical amount as plant depreciation under the authority in the new tax law.

At the end of the five years, the manufacturer may either leave title with the government or, if he prefers may buy the plant from the government at a price equal to the original cost less physical depreciation—figured at a rate agreed upon in the original contract. The rates to be used will vary with each contract but in general will be somewhat more liberal than are allowed by the Treasury for income tax purposes. Typically, an aircraft plant will be depreciated at 5 per cent a year as regards the building, 12 per cent as regards heavy machinery, and 50 per cent a year for portable machinery.

If the manufacturer does not buy the plant, the government will agree to tear down the plant.

As compared with a straight program of RFC loans, this scheme has the advantage of bringing in private capital, thus conserving the RFC's billion and a half, and should also—so gilt-edged is the security—result in substantially lower interest rates than the 4 per cent which RFC charges.

Though the bankable contract is expected to cover most expansion, two other methods are available. In one of several procedures, the government may build and own a plant, hiring a manufacturer to run it or renting it to a manufacturer. This is being used for products—such as smokeless powder—with no commercial market.

Alternatively, a manufacturer may finance his plant himself in a normal manner. If the defense boom lasts, he will profit, since in five years he will have a plant completely written off and belonging to him.

DEFENSE WORK PROGRESSES

WASHINGTON—Donald Nelson, coordinator of national defense purchases, in a recent radio address, summarized progress of the Defense Commission: More than half of the strategic and raw materials needed for the stockpile have been acquired. Contracts have been let for more than 200 warships. A system of vocational training for defense skills has been set up and it covers 100,000 students. Contracts are in the hands of manufacturer for more than 10,000 service airplanes, and builders are preparing to produce 15,000 additional craft. The Commission has cleared contracts, which have been awarded by Army and Navy, in excess of six billion dollars. It is the Commission's purpose to guard against needless sacrifices of peace-time advantages, and to avoid interference with normal democratic and desirable processes.

Tin — Vital For Defense

Tin is a vital element in the defense program, not because substitutes couldn't be used, but because a change from present practices with tin would seriously cut the speed of production. This is particularly true of tinned steel containers for food, fuels, oils, and other commodities. About half of U. S. tin consumption goes into "tin cans." To make cans at the necessary high speed, you have to have solder, which is half lead and half tin. Also vital are babbitt bearings, containing much tin, used through the whole gamut of machinery. Bronz bearings, too, are important. Defense Commission announced that the U. S. received 12,400 long tons of tin in August, and at month-end 22,364 l. t. were afloat to this country. Government agencies have purchased 13,694 l. t. for the stockpile. The U. S. normally consumes 70,000 to 80,000 tons a year; this will increase rapidly.

RFC Loans

Loans totaling $558,959,990 to aid the national defense program were made by RFC from June 25 through September 18. Banks participated in 21 of the total 112 loans, to the extent of $531,491.

Four corporations created by RFC got loans as follows: Rubber Reserve Company, $145,000,000; Metals Reserve Company, (for tin and other metals) $105,000,000; Defense Supplies Corporation (for high-test gasoline) $58,250,000; Defense Plant Corporation (for plant expansion, equipment) $30,000,000.

Twelve loans totaling $188,112,855 went to manufacturers of planes and parts, mostly for expansion of plant; five loans totaling $10,642,500 went to makers of machine tools and precision instruments; incidentaly 46 loans were made to aviation schools operating under CAA pilot training program for 79 small planes.

Loans of special interest, outside of the RFC-created company loans: Consolidated Aircraft, $12,300,000; Bendix Aviation, $18,587,855; unnamed manufacturers of machine tools in Davenport, Iowa, $10,000,000; Grumman Aircraft, $3,500,000; Curtiss-Wright, $51,160,000; Wright Aeronautical, $92,000,000; Bantam car, $125,000; Reynolds Metals, $15,800,000; Boeing Aircraft, $10,500,000.

Canada Permits Plant Write-offs Before Profits Are Subject to Excess Profits Tax

MONTREAL — Since intensified war production has started in Canada industrial companies have had little opportunity to argue over the terms in war contracts. In some cases companies have been told to begin production and that payment would be made. Refusal meant government operation of the plant. However now that the first rush of orders is a reality the government is taking measures to assure fair treatment to industrial plant owners and stockholders. Companies which have made new capital outlays for the production of war materials have been invited to state their case to a War Contracts Depreciation board. The government is permitting companies to make depreciation write-offs before showing profits which are subject to income and excess profits taxes.

In addition a board of referees has been set up by the government to assure that no company or firm will suffer unduly from the excess profits tax which was increased in the last budget from 50 per cent to 75 per cent. Special provision was made for adjusting the standard of profits in the case of new and depressed business. The new referee board will set the standard of "normal" profits on the basis of the four-year period before the war. The board will decide which firms are in the category of depressed industries, and therefore not to be taxed on profits increases like other industries.

New Plants Cost $225,000,000

More than 100 new plants and plant expansions costing approximately $225,000,000 have been contracted for on the part of the British and Canadian governments since the war started. About 35 per cent of the total has been financed by the Canadian government. Orders for war supplies which have been placed, or are about to be placed, by Canada's Munitions & Supply department now total $345,000,000. This amount is divided among 4,400 Canadian firms and the materials ordered include everything needed to equip, maintain, and feed men in the army, naval and air forces. In addition the British government has placed orders for $208,000,000.

Meanwhile in Ontario the first of the big explosives plants being erected by the British government already has started production, 2½ months ahead of schedule. The plant, which employs 3,000 men, has already begun shipments to Britain. Two additional explosives plants, one in Quebec costing $19,600,000 and a $9,000,000 plant in Manitoba, are well underway. Both will be in production next year, as will most of the new government war plants.

In the Montreal area an $8,000,000 English-type shell-filling plant will be in production by November. An American-type shell-filling plant, being built in Ontario at a cost of $8,000,000, will be producing by the middle of next year. In conformance with the new government policy of modeling military production after American products, the latest plants are all of the American type. Further, as many plants as possible are being built in central Canada due to the relative safety of this area from attack.

Gun Production Increased

A $2,500,000 capital investment has been made recently in a rifle factory. $13,000,000 was spent on a 3.7 anti-tank gun plant, and $10,000,000 on a plant to make 25-pounders. $11,000,000 was expended for facilities for making 40-metre guns which also can be used for anti-aircraft purposes.

Sorel Industries Ltd., originally a $5,000,000 plant erected to produce 25-pounders, has been taken over by the government. The plant, which is now a $10,000,000 project, has added facilities for the manufacture of naval guns.

The government is spending $1,000,000 on a plant to make aerial bombs. Canadians are also making Bren guns, Colt-Browning and submachine guns, rifles, torpedoes, and depth bombs. While plants were being built coastal guns were imported from Britain and 18,000 Lee-Enfield rifles were purchased from the U. S. The Government is also spending $62,000,000 at various shipyards.

The following contracts have recently been let by the government: Aircraft, Canadian Vickers Ltd., Montreal, $45,259.20; Canadian Wright Ltd., Montreal, $11,904.41; DeHavilland Aircraft of Canada Ltd., West Toronto, Ont., $8,094.75. Machinery, J. Bertram & Sons Co., Ltd., Montreal, $7,534; Williams and Wilson Ltd., Montreal, $16,650; and Greenlee Tool Co., Rockford, Ill., $10,864; Dominion Hoist and Shovel Co., Ltd., Montreal, $18,144; and Stephens-Adamson Mfg. of Canada Ltd., Belleville, Ont., $285,991.

Shipbuilding, Chantier Maritime de St. Laurent, Ltd., St. Laurent, Que., $28,500; Munitions, British Admiralty, $444,000; Frost and Wood Co., Ltd., Smith Falls, Ont., $28,350; International Metals Industries Ltd., Toronto, $80,050; Rogers Majestic Corp. Ltd., Toronto, $50,193; Federal Laboratories, Inc., Pittsburgh, $346,342; and U. S. Ordinance Engineers Inc., Cleveland, $508,793.

OLDSMOBILE GETS SHELL ORDER

DETROIT—Oldsmobile Division of General Motors has been awarded an order by the Ordnance Department for 9,505,600 shells, delivery to begin in eight months. This order comes on top of Oldsmobile's acquisition of a new press plant and forge shop facilities containing 150,000 sq. ft. of space. New machinery will be necessary, but will be the property of the corporation rather than of the government. This shell contract probably will be followed by orders for other munitions in lesser amounts to other G.M. divisions.

$20,000,000 Airplane Order Is The Biggest In U. S. History

WASHINGTON—Biggest airplane order ever placed in the U. S. went from Army to Douglas for $20,000,000 of transports (about the same as DC-3). The Douglas backlog is up to $400,000,000. Robert Hinckley, boss of CAA training of 45,000 pilots, answering charges that his project is a "boondoggle," says Germany did it, and it wasn't a boondoggle. The United States is a jump ahead of Europe with Navy's new powered gun turret on the Martin patrol flying boats, just starting delivery. Engineers in high places tell us the rotary wing plane will not be worked out till after the present excitement. Big planes, like Martin and Douglas 70-tonners, can carry so much armor and such big guns that present fighters cannot approach them. Big Shots admitted to Washington's back rooms come out saying the United States will pull its guns on Japan before tackling Germany, that the Nippons will back down in face of the American Navy.

CIO Pledges Support to Workers Who Strike in Defense Industry

NEW YORK—The Greater New York Industrial Council, C.I.O., pledged its support to employees of the Ford Instrument Co. who have gone out on strike. The company is making bomb sights for the Navy in its plant at Long Island City.

The whole question of the right to strike in defense industries is involved. The employees of the Ford Instrument Co., which is a subsidiary of the Sperry Gyroscope Co., are members of the United Electrical, Radio and Machine Workers.

Representatives of the Union plan to see Sidney Hillman, Defense Commission's labor co-ordinator, in an effort to come to a settlement. Observers indicate that to allow strikes will slow defense preparations.

INSIDE DETROIT

Auto companies work on 1942 models, but keep one eye on Europe; promise to be spearhead of U. S. defense operations. Lack of supervisors feared when employment reaches high peak

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—As they always do at this time of year, styling and design sections of automobile companies, particularly of General Motors, are working feverishly on models to be offered a year hence. On the surface, that would indicate that car makers feel pretty good about being able to retool for refurnished 1942 models. Actually, they aren't so optimistic. They intend to have all the plans ready on the shelf in case Herr Hitler has subdued everybody in sight or in case the world is made safe for democracy by next spring. Since neither event appears probable, it is likely that 1942 plans will accumulate many cobwebs, and the industry will have to content itself with a few sheet metal changes (and possibly none at all) and call it a day.

Perhaps it is wishful thinking, but local tool and die interests point out that relatively few dies will be needed for the defense program, hence die makers will not be in heavy demand. This is the slack season for tool and die makers around Detroit, and executives have their fingers crossed hoping that these men will not be lured elsewhere by boom-time conditions. Already this year many tool and die makers, because of high rates and overtime, have earned what in normal days would be considered a comfortable year's income. Even so, there is no assurance that they may not be tempted to make a killing while they can. After all, die makers can be used on other work at high rates. One big automobile company thinks it can hold its tool and die makers by continuing to put them on production work when they are not busy on tools and dies. That plan guarantees them a steady income the year round.

Supervisory Help Needed

Automotive executives, looking ahead, are not worrying half so much about a shortage of skilled and semi-skilled men as they are of supervisory help, especially foremen. The depression years washed out many good foremen who have drifted away and no longer are available. Moreover, unionization of the industry put foremen in a tight spot. For the small financial gains, they sacrificed a good deal by being cast out permanently from the workers' ranks, even in bad times. The solution seems to lie in devising ways and means of training new foremen in a hurry and in making it worthwhile for a man to become a foreman. It wasn't so long ago that some foremen were on hourly rates like the men under them.

Unless the world unexpectedly becomes peacelike, Detroit promises to be the spearhead of defense operations six to ten months from now. Detroiters are talking in terms of the highest employment peak in history. Officials are convinced that another silk shirt era is about to be born and are preparing for it. They talk big about aircraft engines, tanks and machine guns being built without interfering with automobile production, but get them off in a corner and they'll confess some doubts. Even with the outlook bullish, they are more cautious in their planning than releases from publicity offices would indicate. One high official is on record as saying that his corporation doesn't intend to accumulate huge inventories of parts, sub-assemblies or finished cars should it appear that it may be hard to get steel or other materials. The management is in a mood to play safe no matter what develops.

The perennial controversies about rates of production and speed-ups between management and union labor at the beginning of a new model season have occurred. Both Chrysler and Fisher Body are reported to have suffered from "sloppy work" strikes which are annoying and costly. The method of meeting the situation has been to close down the plants for the day as soon as workers start such tactics. As the industry swings into volume production, it is believed that these work interruptions will disappear. Incidentally, the feeling is that General Motors this season will not permit itself to be pushed around by the CIO-UAW the way it has been on some occasions.

Ponder Munitions Contracts

The type of munitions contract to be negotiated with auto and parts makers will depend upon the circumstances surrounding each case. Mr. Knudsen has said that plants with no commercial value after completion of the national defense program will be

NO STUDEBAKER AIRCRAFT

DETROIT — Repeated rumors that Studebaker will make aircraft parts for Curtiss-Wright were declared to be without foundation by an executive of the former company. Studebaker has given consideration to a number of projects connected with the national-defense program, but none has been awarded. Whether the South Bend plant will be expanded if defense projects are undertaken depends largely upon the nature of the product.

Giant Engraver—*Entirely automatic is the above engraving machine. It is shown in an operation as it carves a roof die from nickel steel for the 1941 Ford sedan. A "feeler" working along the edge of a model guides the cutting tool as it whittles away at a slab of steel*

U. S. Government Contracts Awarded to Tool Makers

(Defense contracts on page 774c)

Contractor	Gov't Agency	Commodity	Amount
Lodge & Shipley Machine Tool Company, Cincinnati, Ohio	Navy	Lathes	$119,756
Kearney & Trecker Corp., Milwaukee, Wis.	Navy	Milling machines	59,763
Axelson Mfg. Co., Los Angeles, Cal		Lathes	61,459
South Bend Lathe Works, South Bend, Ind.	NYA	Lathes	37,800
International Harvester Co., Chicago, Ill	War	Tractors	2,272,500
Allis Chalmers Mfg. Co., Milwaukee, Wisc.	War	Tractors	1,196,409
National Twist Drill & Tool Co., Detroit, Mich.	Navy	Twist drills	18,333
William Sellers & Co., Inc., Philadelphia, Pa.	Navy	Planer	32,405
Warner & Swasey Co., Cleveland, Ohio	Navy	Turret lathes	10,274
National Acme Co., Cleveland, Ohio	War	Spindle machines	35,272
E. L. Essley Machine Co., Chicago, Ill	War	Honing machine	30,348
R. K. LeBlond Machine Tool Co., Cincinnati, Ohio	War	Boring lathes	108,911
Tidewater Supply Co., Inc., Norfolk, Va	Navy	Turret lathes	17,071
Cincinnati Milling Machine & Cincinnati Grinders Inc., Cincinnati, Ohio	Navy	Milling machines	109,735
Gisholt Machine Co., Madison, Wisc	Navy	Turret lathes	40,297
Reed-Prentice Corp., Worcester, Mass	Navy	Lathes	111,670
Brown & Sharpe Mfg. Co., Providence, R. I.	War	Screw machines	89,115
The Hanson-Whitney Machine Co., Hartford, Conn	War	Milling machines	12,561
The LaPointe Machine Tool Co., Hudson, Mass	War	Broaching machines	12,672
Niles-Bement-Pond Co., Pratt & Whitney Div., Hartford, Conn	War	Milling machines	31,488
Cincinnati Milling Machine & Cincinnati Grinders Inc., Cincinnati, Ohio	War	Milling machines	171,856
Brown & Sharpe Mfg. Co., Providence, R. I.	War	Milling machines	85,200
Heald Machine Co., Worcester, Mass	War	Boring machines	11,641
Austin-Hastings Co., Inc., Cambridge, Mass.	War	Drill presses	74,991
Kingsbury Machine Tool Corp., Keene, N. H.	War	Drilling machine	11,557
Swind Machinery Co., Philadelphia, Pa	War	Lathes	13,080
Henry Prentiss Co., New York, N. Y	War	Grinding machines	14,196
Wilson-Brown Inc., New York, N. Y	War	Honing machines	33,832
William Sellers & Co., Inc., Philadelphia, Pa.	Navy	Planers	156,220
Niles Tool Works Division General Machinery Corp., Hamilton, O	War	Turning lathes	172,500
The Bullard Co., Bridgeport, Conn	Navy	Lathes	64,956
Wm. Sellers & Co., Inc., Philadelphia, Pa	Navy	Machines, boring, drilling and milling	95,248

financed by the government and title will remain with it, although the plant may be operated upon a management-fee basis. The Chrysler tank plant is an example. Plants now having equipment, which can be used or expanded, may be financed by private or RFC funds, and after orders are filled negotiations will be instituted with the manufacturer to take over the facilities upon the basis of fair value, subject to approval by the Secretary of War or Navy. The Commission has also worked out a "plant facilities" contract, which is separate from the parts contract, and which guarantees the manufacturer the cost of plant additions or new plant over a five year period, but protects the government's equity.

G.M. Has Machine-Gun Contract

General Motors' machine-gun contract provides that the equipment necessary to the program shall be paid for and remain the property of the government, while the corporation will build and own any new structures involved, either to house gun manufacture or displaced domestic products. Machine gun manufacture will be set up as special departments at the Saginaw Steering Gear Div., Saginaw, Mich., AC Spark Plug Division at Flint, Frigidaire Division at Dayton, and the Guide Lamp Division at Syracuse. The regular division managers and operating personnel will be in charge, but the government work will not impair production of domestic goods, will not be intermingled therewith.

The contract provides $20,000,000 for equipment, some of which is already on order, and $61,319,882 for the machine guns. It is estimated that approximately 70,000 guns are involved, with Saginaw, AC and Frigidaire sharing about equally and Guide Lamp having a lesser amount. Guns for several purposes are covered in the contract; also two calibers, 30 and 50. The number of guns involved is large, but considering the requirements of the projected field forces, plus aviation, it is apparent that these facilities must be increased.

The new building program will be completed this winter, according to present plans, and gun manufacture will commence within a year to fifteen months. Production studies preparatory to manufacture of machine guns have been going on for more than two years at General Motors in cooperation with the War Department. It appears that operations will be well tooled but that specialized high-production machinery is not needed, even if obtainable.

Milling Presents Problem

One of the chief problems in machine gun manufacture is the heavy proportion of milling operations. Some of these operations will be set up for continuous production, others will require the use of interchangeable fixtures. Drilling, tapping and reaming operations may be combined upon a multi-head machine, but sliding fixtures will be chosen instead of attempting high-production setups with indexing tables. Threads may be milled on automatic equipment.

Frigidaire has announced that machine gun manufacture will be carried out in additional facilities, including a new five-story building. AC will devote existing space to the gun contract, re-align domestic operations without impairing production, and eventually erect new structures for its own use. Saginaw Steering Gear will erect new buildings for gun operations, but probably at some distance from present facilities. It is unlikely that any of these new buildings will be of windowless construction similar to the Allison plant and the Ford airplane plant now under construction. Guide Lamp has space available.

Ford's Plant Air-Conditioned

When completed, Ford's new airplane plant will be in marked structural contrast to the adjacent Tool & Die Plant and other nearby buildings. The other structures (only two years old) are mainly glass, while the airplane plant will be of windowless construction. Further the Ford plant is designed to provide an interior free of wide temperature changes and capable of being air-conditioned so that the most comfortable working conditions are attained for precision manufacture. There is no truth in rumors that the Ford airplane plant is the first building to be erected in this country for complete blackout.

The airplane plant will measure 360x1,000 ft. The main section will comprise two stories approximately 950 ft. long, while an end section will be three stories. Second floor of the manufacturing section will be devoted to machining operations, first floor to assembly. The end section will include an aircraft training school and dining rooms. A new construction idea involves use of the lower flange of the second-floor girders for mounting low-headroom cranes.

NLRB OUTLAWS BLACKLISTING

WASHINGTON — Maintenance by an employer of a blacklist of people he doesn't want to hire because of their union affiliations will be pretty dangerous if the courts uphold the NLRB decision in the case of Nevada Consolidated Copper. The board ordered the company to "reinstate" with back pay four men who did not apply for work when the mine resumed operation. The board decided that the men did not apply because they had reason to believe they would be refused and that their names were on a blacklist so that if they had applied they would have been refused. Circuit court has already upheld a board decision that an employer may not refuse to hire a man because of his union membership.

Colwell and Beechcroft Get S.A.E. Nominations for 1941-42

NEW YORK—A. T. Colwell, vice president of Thompson Products, Inc., and David Beechcroft of Bendix Products Division, Bendix Aviation Corp., have been nominated for 1941 President and Treasurer, respectively, of the Society of Automotive Engineers.

For the term of 1941–42 the following have been nominated for membership on the SAE council: N. C. Millman, General Motors of Canada, Ltd., H. O. Mathews, Public Utility Engineering & Service Corp., and D. A. Fales, Massachusetts Institute of Technology.

Nominated for vice presidents are: Mac Short, Vega Airplane Co., Dr. George W. Lewis, National Advisory Committee for Aeronautics, L. C. Lichty, Yale University, J. B. Macauley, Jr., Bendix Aviation Corp., J. R. Hughes, Studebaker Corp., E. S. Chapman, Chrysler Corp., Chauncey W. Smith, University of Nebraska, T. L. Preble, Tide Water Associated Oil Co., and R. S. Reed, Brockway Motor Co., Inc.

Association of Manufacturers Takes Defense Plant Inventory

NEW YORK—The management of industry in this country has already "volunteered" and that business rather than government effort is putting the most drive into the national defense, declared H. W. Prentis, Jr., president of the National Association of Manufacturers. The association, its Industrial Council and 243 affiliated organizations, is conducting its own "nationwide" inventory to reveal all unknown defense potentialities of small and large plants. This move is designed to supplement the stock-takings of the procurement divisions of the Army and Navy for mobilization day. It is one of the major points in the N.A.M. program to effect complete co-operation of industry in the preparedness drive.

Other phases are: An economic study of war financing, war price and war labor control, in the light of British, French and German experience, and an industrial research survey, designed to stimulate an increase in the percentage of corporate income spent for encouraging national inventive genius in developing military, naval and air strength.

The association's survey on war financing, price and labor controls will be completed soon and forwarded to the national administration in Washington. The research was instituted by Dr. Karl Compton, president of the Massachusetts Institute of Technology and chairman of the association's advisory committee on scientific research.

Elected President

GEORGE J. ZIMMERMAN

Becomes President

EARL D. POWERS

New Chairman

B. L. WATERS

NAMES in the NEWS

George J. Zimmerman, formerly vice president and general sales manager of Strong, Carlisle & Hammond Co., was elected president of the company. Mr. Zimmerman, who has been actively associated with the company for 39 years, began as an office boy. In 1905 he was advanced to the machinery department where he served as sales manager to 1937. At this time he was elected vice president and general sales manager. He has been a director of the company for 20 years and he is also a director of the Hammond Manufacturing Co. and Clark Manufacturing Co. of Cleveland, both of which are subsidiaries of the parent company.

William W. Finlay was appointed manager of the new manufacturing division of Wright Aeronautical Corp. which will be established at Lockland, Ohio, near Cincinnati. He has been affiliated with the corporation for the past 13 years and for the past two years Mr. Finlay has been engaged in special assignments for the general manager in addition to directing the activities of the license division. In 1927 he entered the organization as time-study-engineer, rising rapidly to manager of the production division.

S. C. DuTot was promoted to the post of general manager in the Birmingham, Pittsburgh, Cleveland and Detroit areas of the Electro Metallurgical Sales Corp. W. E. Remmers was appointed division manager of the Chicago Corp. and R. E. Brown was named division manager of the Pacific coast.

F. W. Werner has been appointed assistant to the president in charge of coke by-product sales of all subsidiary companies of the United States Steel Corp. of Delaware. Mr. Werner has been in the employ of the Corporation since 1907, and was appointed assistant to vice-president in charge of sales in 1938. He has held this position until his recent appointment.

B. L. Waters, former president, has been elected chairman of the board of Lyon Metal Products, Inc. Earl D. Powers, formerly vice-president and general manager, has been elected president of the company. Mr. Waters succeeds H. L. Gardner, general counsel of the company, who resigned.

George H. Johnson succeeds his father, Hobart S. Johnson as president of Gisholt Machine Co. He represents the third consecutive generation of the Johnson family to hold this position, as the company was founded by his Grandfather, John A. Johnson, in 1889. Hobart S. Johnson was named chairman of the board, and H. S. Johnson, Jr. was elected a vice-president.

John P. Major, traffic manager for the Worthington Pump & Machinery Corp. in Buffalo, has completed 50 years of service with the company.

M. J. McKeever was appointed manager of Crucible Steel Company's Atlanta branch. He has been an employee of the company for 15 years.

P. J. Christy has been appointed manager of the Philadelphia, Pa. office of Chicago Pneumatic Tool Co. He succeeds A. M. Brown, who has been transferred to Washington, D. C. as the manager of the branch recently opened there.

Frank W. Robertson has been named general manager of the Edward W. Voss Machinery Mfg. organization.

Chief Engineer

JOHN W. HARSCH

Engineering Director

W. RICHISON SCHOFIELD

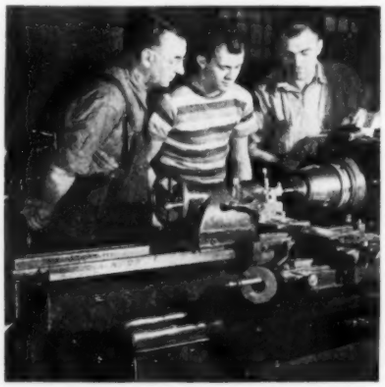
W. Richison Schofield, formerly chief engineer of Leeds & Northrup Co., has recently been appointed director of engineering. John W. Harsch, assistant chief engineer, has been advanced to chief engineer, and Mr. Harsch's former position has been filled by the promotion of John F. Quereau. Mr. Schofield, an authority in pyrometry and automatic control, joined the company in 1916, and since 1928 has held the position of chief engineer. Mr. Harsch joined the organization in 1924 and in 1928 became assistant chief engineer. Mr. Quereau has been associated with the company since 1929.

Charles Koch, Edward Koch, Sr., and Edward Koch, Jr., three generations of the same family, are all employed as machinists by the General Electric Co. Charles Koch, who operates a boring mill, has been associated with the company for 48 years. His son, Edward, Sr., who is also a boring mill operator, has had 22 years of experience with the company; while Edward Jr., has just finished the first year of his four-year apprenticeship.

J. H. Marks, purchasing manager of Packard Motor Co. since 1925, was elevated to the position of vice president in charge of procurement, machinery and accessories in connection with the Rolls Royce engine project. In addition Marks will supervise the erection of new buildings and other details growing out of the expanding war plane contract. He has been associated with the organization since 1916 when he joined the company as superintendent of construction.

Ernest L. Mawhinney, Personnel director of the Jessop Steel Co., was recently appointed safety director of the company.

R. L. Hibbard has been named to the Detroit merchandising sales staff of Cutler-Hammer, Inc. He has been a member of the organization since 1936 when he began as a member of the company's student training corps.



Three Generations—*Of the same family are Charles Koch, Edward Koch Sr. and Edward Koch Jr. All are boring mill operators*

BUSINESS ITEMS

The Whiting Corp., Harvey, Ill., has purchased the Quickwork Co., formerly of Ohio and Chicago, Ill., and manufacturers of rotary shears, stamping trimmers and forming machines, power hammers, and flangers. The entire Quickwork line will be manufactured by the Whiting Corp. at Harvey. Stevens H. Hammond, vice-president of the Whiting Corp., will be in charge of all Quickwork operations.

Rein & Webster, Inc., manufacturers' representatives, began operation this month at Cleveland, Ohio. The company will carry a full line of die castings, plastics, stampings and screw machine products. Frank H. Webster, formerly director of purchases for the White Motor Co., is president.

Four units of the former Willys-Overland plant have been acquired by the Boyce-Crane Company.

PLANT EXPANSION

Spencer Lens Co. is building a $1,250,000 addition to its present plant.

The Buffalo Foundry & Machine Co. is building a $24,000 addition to its plant, and will purchase $40,000 worth of new machinery.

Armstrong-Blum Mfg. Co., manufacturers of hack and band sawing machines, have started construction of an addition to their plant that will increase their floor space nearly 100 per cent.

The Hanson-Van Winkle-Munning Co., Matawan, N. J., manufacturers of electro-plating equipment and supplies, are expanding plant facilities due to increased demands.

MEETINGS

Society of Automotive Engineers. Annual dinner. Hotel Commodore, New York, N. Y., Oct. 14.

American Gas Association. Annual Convention. Atlantic City, N. J. Week of Oct. 7.

National Metal Exposition, Cleveland, Ohio. Cleveland Public Auditorium. Oct. 21-25.

National Safety Congress and Exposition. Stevens Hotel, Chicago, Ill. Oct. 7-11.

Society of Automotive Engineers. National Aircraft Production Meeting. Hotel Biltmore, Los Angeles, Calif. Oct. 31-Nov. 2.

American Society for Metals. Annual convention. Hotel Statler, Cleveland, Ohio. Oct. 21-25.

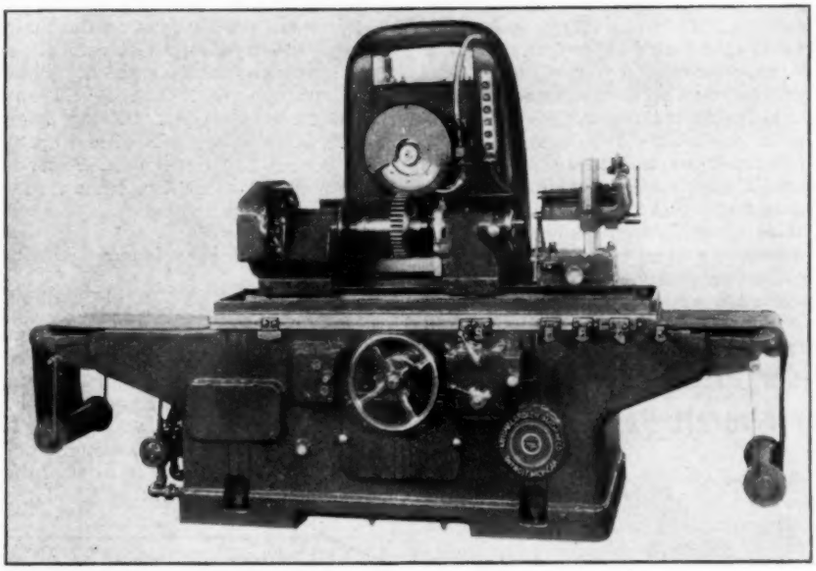
American Welding Society. Annual convention. Hotel Cleveland, Cleveland, Ohio. Oct. 20-25.

The Wire Association. Annual convention. Carter Hotel, Cleveland, Ohio. Oct. 17-23.

American Society of Tool Engineers. Semi-annual convention. Cincinnati, Ohio. Oct. 17-19.

American Gear Manufacturers Association. The 23rd semi-annual convention, Skytop Lodge, Skytop, Pa. October 14, 15 and 16, 1940.

SHOP EQUIPMENT NEWS



Precision Gear and Broach Grinder Developed by National Broach & Machine

Increased production of quality gears with particular emphasis on accuracy is claimed for the "Red Ring" gear grinding machine, which was developed originally to meet the demand for precision grinding of master gears and involute broaches by National Broach & Machine Co., 11457 Shoemaker St., Detroit, Mich.

Utilizing a U-column, the machine is exceptionally rigid, with wheel spindle mounted on long bearings. Spindle is integral with motor rotor, and spindle slide is adjustable vertically by a handwheel. Hydraulic counterbalance removes backlash from the lead screw.

Table slide is hydraulically reciprocated and automatically controlled through a feed box on the front of the machine. Table speed is controlled accurately. Combination flat and V ways are covered at all times by a canvas roll and are provided with automatic force-feed lubrication.

Index head is furnished with either fully automatic or semi-automatic control, with the semi-automatic providing somewhat greater accuracy. Both coolant and hydraulic pumps are located on the outside of the machine. Reservoirs are inside the base.

For gear tooth work a templet control trimmer is provided which trims both sides of the wheel simultaneously. The table feed box includes a dead stop which brings the wheel to trimming position so that the diamond points operate exactly on the center line. Radius trimmer is mounted in the tail stock. Diamond points are vertically adjustable and may be set with a micrometer.

"Senior" Hydraulic Presses Announced by Colonial Broach

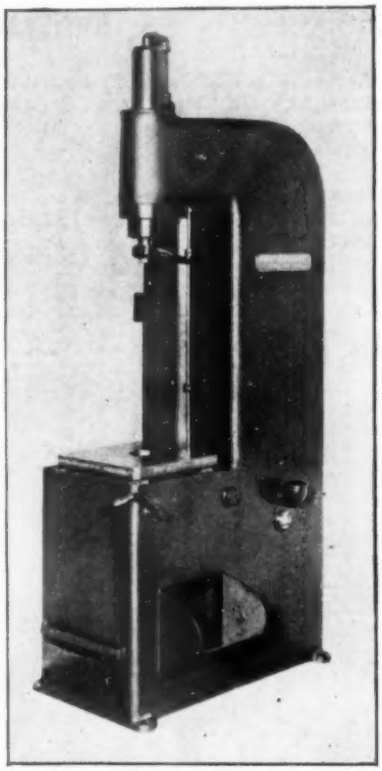
A line of general purpose hydraulic presses for such operations as assembling, broaching, etc., has been developed by Colonial Broach Co., 147 Jos. Campau St., Detroit, Mich. Designated as the "Senior" line, these presses range in capacity from 1 to 10 tons, with strokes ranging from 18 to 42 in.

Designed for maximum flexibility, they have motors located in the columns, requiring minimum floor space. Open side fixed table construction permits working on long parts which would extend beyond the machine table. Exceptional daylight allows for large fixtures, without sacrificing stroke. Work platen is removable for machining special clearance holes.

Rugged reinforced construction is used for frames. Cylinder bearings are in frame necks, eliminating unsightly protrusions. Cylinder is a leak-proof steel tube for maximum efficiency. Standard hydraulic pumps and equipment are used for economical replacement. Pumps are of large capacity, direct motor-driven. Located within the oil tank, the pump has exceptionally short suction.

Large coolant flow where required, as for broaching, is provided by an oversize centrifugal pump driven by a separate motor. Chips may be removed while machine is in operation.

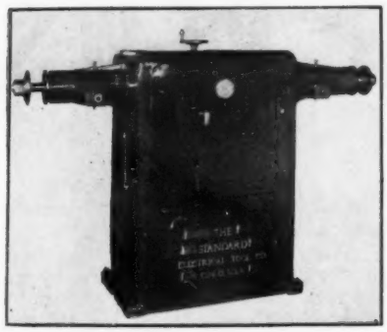
"Senior" presses can be furnished with controls to stop operation at top or bottom of piston stroke, or with an automatic return after the piston has completed its downward travel. A special hydraulic circuit is available which permits the use of shuttle type fixtures if desired, to speed up unloading and loading, while assuring



maximum safety to the operator. Presses are available in seven sizes: 1-ton, 18-in. stroke; 3-ton, 18- or 24-in. stroke; 6-ton, 24- or 36-in. stroke; and 10-ton, with 30- or 42-in. stroke. Floor space of the 1-ton model is only 18½x30½ in., with 29x51-in. for the largest model.

"Standard" Polishing Lathe Has Infinitely Variable Speed

Standard Electrical Tool Co., 1940 W. 8th St., Cincinnati, Ohio, has developed an infinitely variable speed buffing and polishing machine which pro-



vides correct speed for each operation, using any size or type of wheel. Longer wheel life and more efficient production are also claimed, with an additional saving reflected in that worn wheels need not be discarded.

Speed changes are accomplished merely by turning a handwheel. Each change of spindle speed is shown in r.p.m. on the indicating dial. Full speed range is 1,000 to 3,500 r.p.m.

All equipment, including speed changer, constant-speed 1,800 r.p.m. ball bearing motor and magnetic starter, is inclosed inside the base, while the pushbutton station is located at the front. Removable louvered covers at sides and front and a large removable cover at top front provide easy access to inside of base.

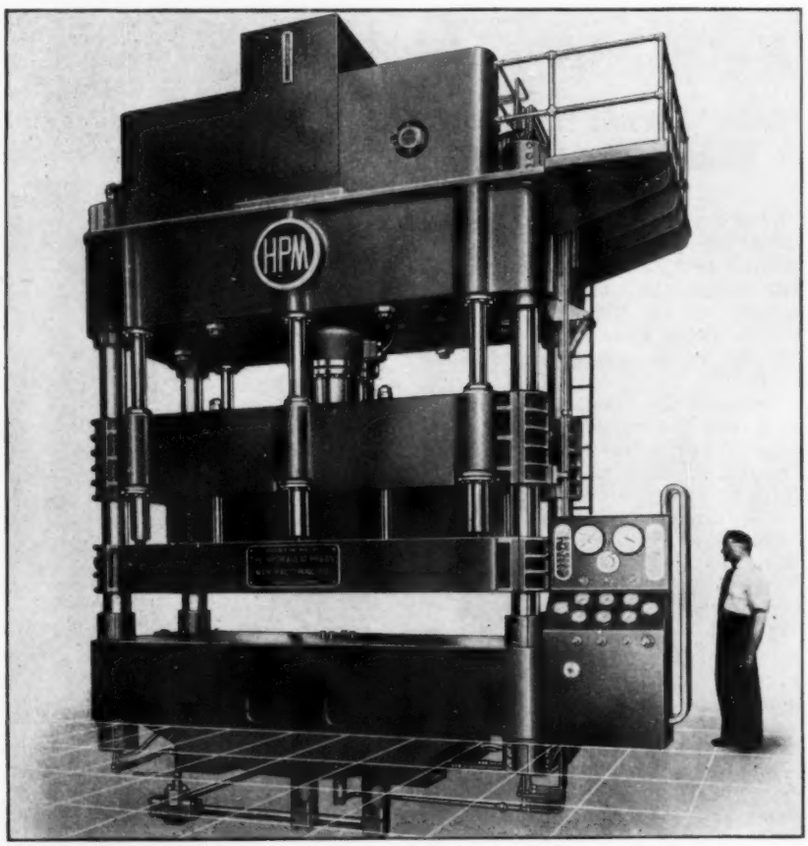
Available in 3, 5 and 7½ hp. sizes, with larger sizes furnished to order, this machine is said to incorporate simple construction and easy operation, with quiet and smooth performance. Straight front pedestal permits wheels to extend beyond the machine proper, allowing ample freedom of operation and foot room.

650-Ton Triple-Action Blankholder Press Designed for Aircraft Parts Production

A recent development of Hydraulic Press Mfg. Co., 20 E. Broad St., Columbus, Ohio, is a 650-ton triple-action blankholder press designed especially for deep drawing gasoline tanks and other similar parts for the aircraft industry. This press embodies three separate hydraulic actions for operating the main draw punch, the blankholder ring and the die bottom of the regulation triple-action drawing die. Draw punch is carried by the main slide actuated by the main hydraulic press ram of a double acting piston type.

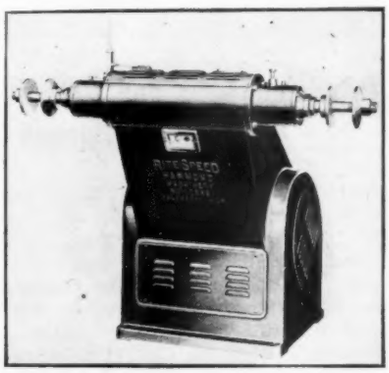
Among the exclusive features of this "H-P-M Fastraverse" press are: accurate alignment of blankholder die ring rigidly supported by blankholder platen directly above; individual pressure adjustment of each blankholder ram, permitting variation of blankholder pressure at six separate points; all three hydraulic actions functioning from only one "Hydro-Power" piston type radial pump direct connected by one flexible coupling to one electric motor; and a closed circuit operating system providing smooth action with valveless and shockless press reversal.

Pressures are 650 tons on the main platen, 250 tons on the blankholder, and 133 tons on the die cushion. Pressing surfaces are 144x72, 144x72 and 59x35 in. respectively. Closing speed is 260, pressing speed is 45 and opening speed is 260 in. per min. Power is furnished by a 100-hp. motor.



Hammond Polishing Lathe Has Overhanging Spindle

An addition to the "Rite-Speed" line of polishing and buffing lathes offered by Hammond Machinery Builders, 1618 Douglas Ave., Kalamazoo, Mich., is the Model No. 10-ROH which features an overhanging spindle protruding 12½ in. over the lower front of the base. This feature makes the lathe



particularly suitable for work on large, bulky pieces.

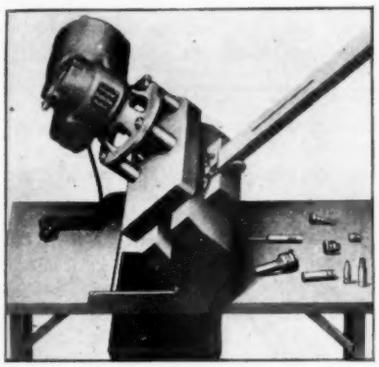
Standard equipment includes lock for holding spindle when changing wheels, a combination switch and brake which shuts off the motor and stops the spindle, automatic motor starter, and a 10-hp. motor with multiple V-belt drive mounted inside the base of the machine.

"Hoffman" Production Marker Operates at High Speed

Identified as the "Hoffman" production marker, a marking machine built by Quality Die Co., 9311 Baltimore Ave., Chicago, Ill., has been designed for high-speed marking of light or heavy formed metal parts, for rolling in metal identifying trade names, and for other identification. A production speed as high as 7,000 pieces per hour is possible without jamming, in marking such products as shells, carburetor jets, venturi tubes, spark-plug bodies, and other round tubular or solid parts.

Machine is driven by a gearmotor,

without chains, belts or pulleys. Driving mechanism is fully inclosed, with sealed bearings used throughout. Gears are greased through Alemite fittings. Specially made marking die can have any number of lines and can



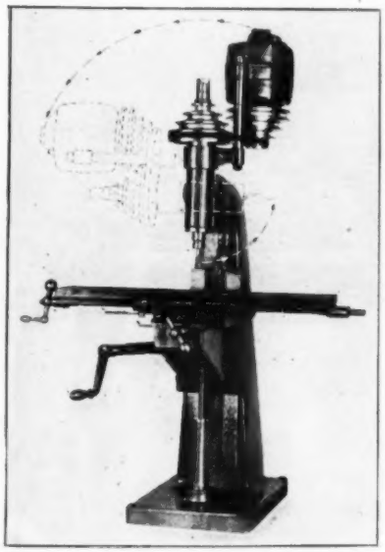
embody insert types to permit changing numbers.

Actual operation of the machine is automatic. Hand-feeding of parts to the gravity-feed chute is the only hand operation required.

"Univertical" Milling Machine Designed for Smaller Jobs

The "Univertical" high-speed end milling machine has been developed by J. D. Duffy & Son, 544 Insurance Exchange Building, Detroit, Mich., especially for small jobs and for those simpler operations which normally must be done on machines costing five times as much. Equipped with a swivel head graduated 90 deg. on both sides of the perpendicular, this compact machine mills, drills and bores. It can also be adapted to small grinding operations.

A bench type machine with a base 11x17 in., it is powered by a heavy-duty ¼-hp. motor, driving through a four-speed V-belt pulley, permitting



a range of from 850 to 3,400 r.p.m. Over-all height is 37 in. Table maximum lift to the end of the spindle is 10 in. with a work clearance of 6½ in. from the center of the spindle to the supporting column. Table, 24x4⅞ in. with T slots, has a cross travel of 17 in. with a forward and back travel of 7 in. All table movements are graduated to 0.001 in.

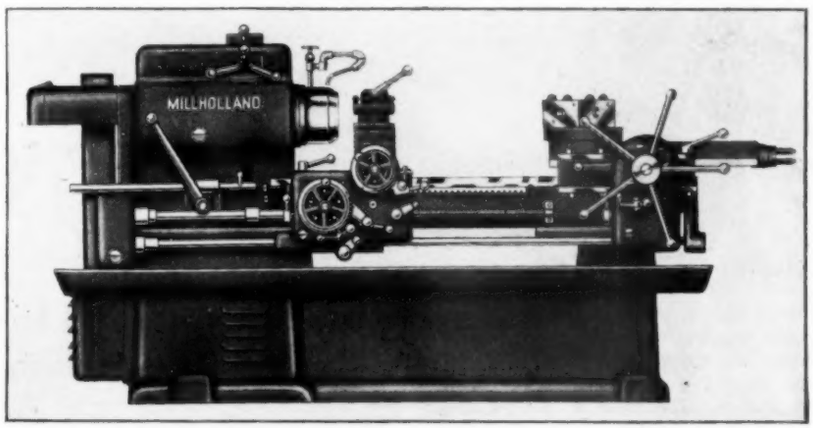
Ball Joint Machine Vise Locked at Any Angle

Any compound angle can be instantly obtained with the "Strickland" universal ball joint vise made by Engineering Service, Inc., Box 44, Huntington Park, Calif. A time-saving precision instrument, this device provides quick and accurate settings in any horizontal angular position, any vertical angle combined with any horizontal angle, and any compound vertical angle combined with any horizontal angle. Settings are obtained by

matching the ball joint vertical degree graduation with the horizontal degree graduation required.

Vise is rigidly locked with a single movement of a clamp wrench. An adjustable leather dust apron, not shown, is furnished for protection. Range of the device is 30 deg. through the horizontal plane. Height is 5 in. and width is 5¼ in.

Improved Universal Turret Lathes Built to Provide Increased Rigidity



Greater rigidity through the use of a box section sub-base which extends under the full length of the bed is one of the features of the improved No. 4 universal turret lathe offered by W. K. Millholland Machinery Co., 1115 E. 35th St., Indianapolis, Ind. Swinging 20 in. over the ways, and available in 1¾, 2 and 2½-in. bar capacity, this machine has a universal carriage with longitudinal travel of 24 in., and a turret ram with a travel of 12 in.

Spindle is mounted in double-row precision Timken roller bearings at the front and a large diameter precision ball bearing at the back. Spindle nose is heat-treated and ground with a taper pilot for mounting chucks, automatic bar chucks, or other work holding equipment. Drive shafts are mounted on selected ball bearings. Both gears and drive shafts are made of alloy steel; shafts are multiple splined and finished after heat-treatment. Headstock has twelve speeds forward and reverse from 35 to 715 r.p.m., with automatic spindle brake.

Bed is of deep box section, well ribbed and with the headstock and bed cast solid. One-piece hardened and ground steel V-ways are provided. Sub-base is of one-piece box construction, and extends under the full length of the bed. Motor is mounted on an adjustable base inside the sub-base with drive to main shaft by multiple V-belts.

Automatic chuck and bar feed are operated by a lever in front of the bed. Chuck has a master collet in which may be attached collet bushings for different sizes and shapes of stock.

Universal carriage is exceptionally heavy, and is provided with both cross and longitudinal feeds, reversible in the apron. There are six feed changes in the apron, with six additional feeds obtained through the gear box at the

headstock. Friction clutches are provided for both cross and longitudinal feeds. Feed trip-off for the longitudinal feed is operated automatically by four adjustable-length stops. Cross feed has four adjustable stops for tripping the feed in either direction. Apron shafts and gears are hardened and run in an oil bath. Bearings are anti-friction.

Turret slide is operated by a turnstile rack and pinion. Turret is of large diameter and revolves on a steel seat to which it is firmly clamped by an automatically operated double bevel clamp. All operating functions of the turret are controlled by movement of the turnstile handle. Turret saddle has six feed changes in the apron, with six more feed changes through the headstock gear box.

Turret is bored so that long stock can pass through it. Turret feed is engaged by a friction clutch. Feeds are automatically tripped by independent adjustable stops.

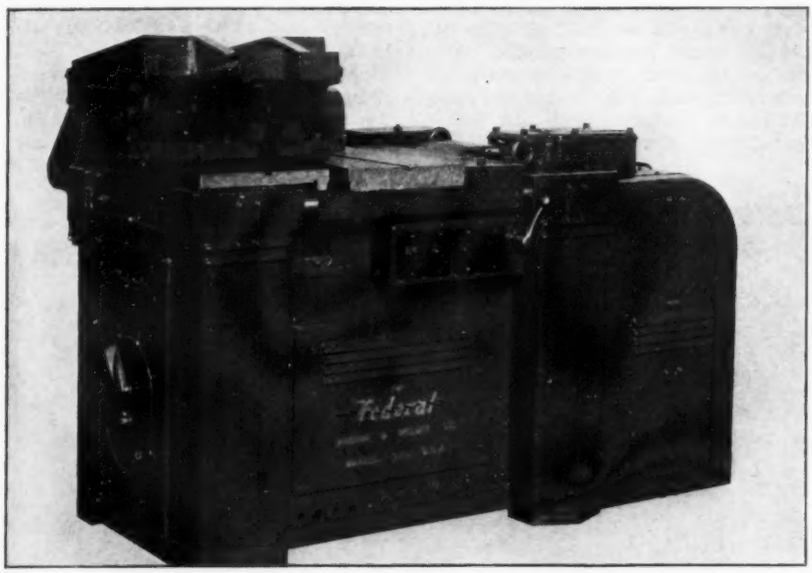
"red E set" Dial Gage Holder Permits Remote Position Control

The "red E set" dial indicator holder offered by red E set Co., 89 State St., Boston, Mass., is claimed to be the only holder made with a ball and socket joint and remote control. Cap-

able of holding all makes of dial gages, both old and new, this device has a ⅜-in. square base to fit any toolholder, and enables the gage contact point to touch almost any spot with only one adjustment.

The primary adjustment, easily accessible and 5½ in. away from the work, does 90 per cent of the adjusting. A secondary adjustment permits approximate positioning of the instrument. Tubular construction gives maximum rigidity. Weight is less than 7 oz.

Protection with Accessibility Featured In Design of New Federal Flash Welder



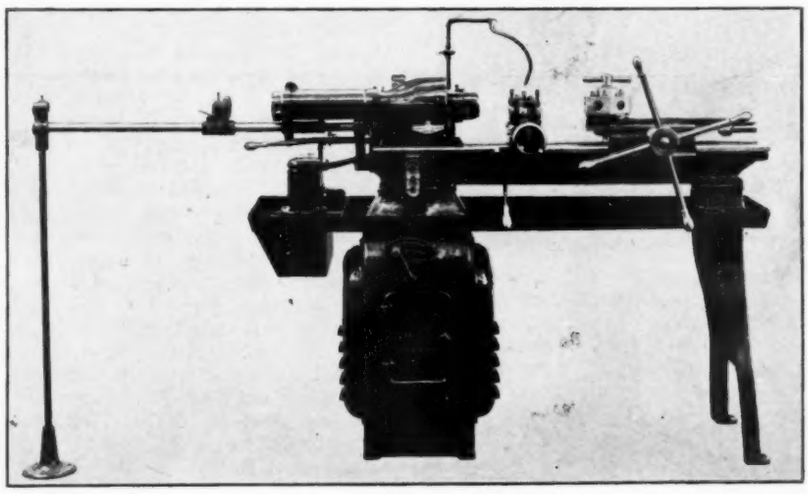
Maximum protection of operating parts without sacrificing accessibility is an outstanding design feature of the Type F-4 flash welder developed by Federal Machine & Welder Co., 212 Dana St., Warren, Ohio. This machine is made in transformer capacities up to 150 kva., suitable for welding stock having up to 1 sq. in. of welding area. It may be used for round, flat, or formed sections.

Welder incorporates side bar construction, which has the effect of a very long slide for the moving platen. With this arrangement the slide is continuously lubricated in sealed bearings on each end of the frame supporting members. Machine has flat top platens for mounting various types of clamping fixtures. Parallel keyways assure accurate alignment of these fixtures.

Drive arrangement, mounted on the moving platen end of the machine, is enclosed, and at the same time is accessible by removing the enclosure covers. Mechanism is motor driven through a variable-speed transmission and gear reducer. Cam which controls the flash and upset period of the weld is covered to protect it from flash and dirt.

Brown Underneath-Drive Screw Cutting Machine Employs Easily Operated Belt Shifting Device

Utilizing its recently patented belt shifting device, Brown Machine Co., 16 N. May St., Chicago, Ill., has developed a new model underneath-drive screw cutting machine. The belt is shifted from step to step on the pulleys by a shifting device consisting of two sliding belt guide arms moved by a hand lever located on the front of the cabinet. It is unnecessary to



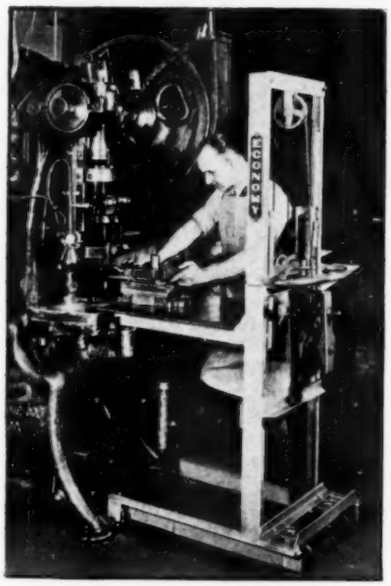
loosen the tension of the belt by a large crank or to raise the headstock cover and shift the belt by hand. Hole through the preloaded Timken bearing mounted alloy steel spindle is 1 in. in diameter. Coolant pump is furnished. Power feed is optional.

Die Handling Time Reduced With Economy "Shoplifter"

Simplicity and economy characterize the "Shoplifter" developed by Economy Engineering Co., 2653 W. Van Buren St., Chicago, Ill., for faster, safer and easier handling of dies. With this machine any workman can pick up a die, transfer it through the plant and lift it onto the press or storage shelf with a minimum of time and effort.

In addition to handling dies, this device is also useful for lifting other heavy metal parts, and for stacking boxes, skids, and drums. It can also be used as a truck for materials handling, and can serve as an adjustable table for machine work.

A hand-operated hoist raises and lowers the platform to any desired

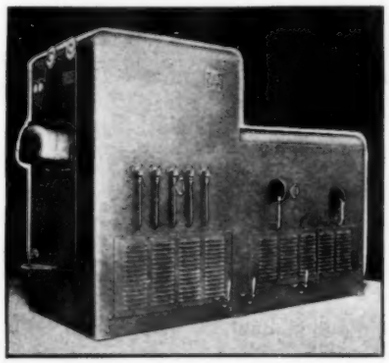


height from 8¼ to 57 in. above the floor. An automatic clutch holds the platform at any height until cranked down. Large wheels make possible easy handling. An arc welded structural steel frame insures rigidity. Capacity of the unit is 500 lb. It weighs 250 lb.

"Lithco" Atmosphere Furnaces Simplify Heat-Treating

Using a specially developed compound having the property of neutralizing furnace gases, the "Lithco" atmosphere furnace developed by Lithium Corp., 175 Fifth Ave., New York, N. Y., permits heat-treatment of iron and alloy and carbon steels without danger of carburization, decarburization, scaling, nitriding or hydrogen embrittlement. In this furnace, steels of different carbon analyses can be heated simultaneously, with no change in the surface analysis of any of them.

Atmosphere in the furnace is claimed to be more than chemically neutral. It is one in which the neutralizing element is in excess. Thus, any oxygen released from water vapor, air, carbon dioxide, carbon monoxide, oxides of nitrogen, adsorbed or occluded gases and vapors, or moisture-contaminated hydrogen or nitrogen is



absorbed by this neutralizer. A carrier gas, generated within the furnace, entrains the vapor which evolves continuously from the cartridge refill and bathes the work being heated in this neutralized atmosphere. Danger from injurious and highly explosive gases is completely eliminated.

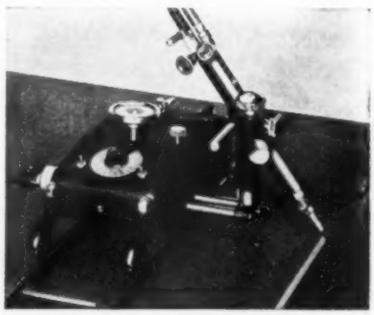
Control of the furnace is fully automatic. It is a self-contained unit, with no moving parts. Furnaces can be furnished in all sizes of batch and continuous types. A pedal-operated ball-bearing ratchet-stop self-locking door is provided. Furnace is completely insulated with 12-in. walls, with specially designed tunnels and alloy burners. Special venting tubes provide recirculation for uniform muffle temperatures.

Portable Gas Cutting Machine Built for Unusual Accuracy

The Model K portable motor-driven gas-cutting machine developed by Harris Calorific Co., Cleveland, Ohio, has been designed with a low chassis and underslung torch holder to eliminate vibration and assure exceptionally true cuts. Powered by a universal electric motor, it will cut straight lines of any length with either square or beveled edges and will cut circles from 1 to 86 in. in diameter. Machine has a speed range of from 3 to 60 in. per min., forward and reverse. An instant stop feature permits cutting of sharp angles, and a tracing attachment provides for cutting of irregular forms.

Mounting for two torches is provided. Maximum traction is assured by the use of two large hardened drive wheels. Swivel follower wheels provide 4-point support. A one-point oiling feeder line to all bearings provides constant lubrication.

Several different torches are avail-

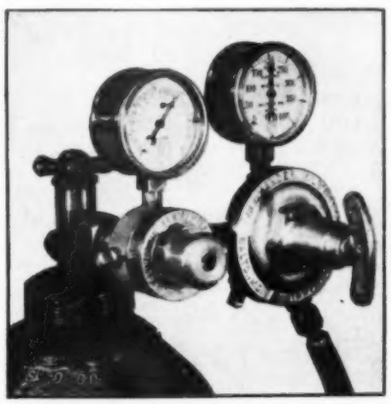


able to permit the machine to use acetylene, propane, natural gas or other fuel gases. Standard equipment includes cutting torch and tip, universal torch mounting, circular cutting attachment and a 5-ft. track. Machine weighs 45 lb. complete.

Milburn Twin-Stage Regulator Features Double Adjustment

An outstanding advantage of the Type FF "Twin-Stage" regulator offered by Alexander Milburn Co., 1416 W. Baltimore St., Baltimore, Md., is that the first stage can be adjusted to various pressures, thus permitting it to be used for different operations. After the selected pressure is set, the delivery stage may be adjusted to any desired working pressure up to 200 lb. per sq. in. It operates smoothly and permits uniform delivery.

Promoting simplified construction is



a unitary valve assembly, which is used in both stages. This assembly has only four parts: a small body, stainless steel spring, stainless steel ball, and special Vulcanite seat. These are operated by a Monel metal pin. Seating is with instead of against the pressure. Each stage has a loose, re-

placeable diaphragm, and removable and interchangeable inlets, adaptable to any tank or line connection for any type of gas. Non-corrosive cylindrical filter screens inclose seat units, thus insuring protection from dirt and foreign particles. Bodies and adjusting keys are of forged bronze.

The first stage of this regulator can be purchased separately and attached to practically any type of single-stage regulator, converting it to two-stage control. Only simple adjustments are necessary.

Belt Shifting Eliminated By Lima Gear-Shift Motor

An automotive gear-shift providing instant speed changes without any belt shifting has been made available for machine tool application by Lima Electric Motor Co., a subsidiary of Lima Armature Works, Inc., 440 N. Main St., Lima, Ohio. This unit gives

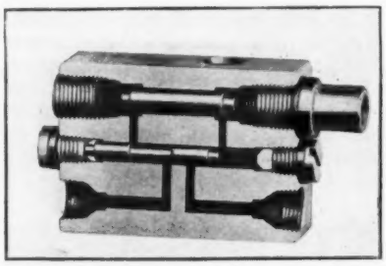
three speeds forward and one reverse, or four speeds forward when reversing can be accomplished through the motor.

Gear-shift is built both as an integral part of the motor and as a separate unit which can be used with any standard motor. A special bracket for mounting on lathes is also made. The device is claimed to increase both safety and production on such tools as lathes, milling machines, planers, drill presses and grinders.

Centralized Lubrication System Applicable to Small Machines

A development in centralized lubrication which brings its advantages to small machine tools has been announced by Farval Corp., Cleveland, Ohio. Known as the "Dualine Jr." system, these installations operate on the same piston displacement principle of measurement as employed for the past twelve years in larger systems on heavier machines. Size has been greatly reduced to provide correct application to small machine tools and other equipment.

In keeping with smaller pumps and measuring valves, a corresponding line of fittings, hose, couplings and

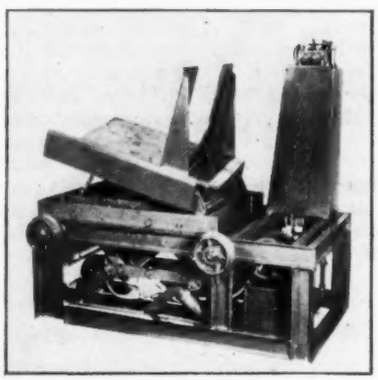


other accessories has been produced. Valve itself has only two moving parts. It contains no springs nor check valves, and is fully adjustable. Positive delivery of lubricant to each bearing is made independently of the judgment of the oiler.

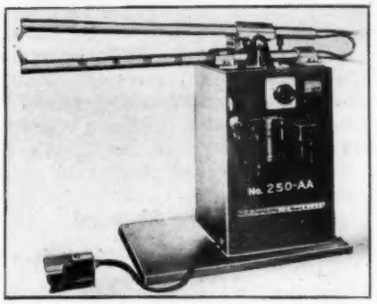
Lyon 5-Ton Elevating Truck Unloads Strip Steel Coils

Designed for unloading coils of strip steel from the recoiling machine, a 10,000-lb. capacity hydraulic elevating truck has been developed by Lyon Iron Works, 538 Madison St., Greene, N. Y., for operation on a track approximately at floor level with the lower portion of the truck in a pit.

This truck is of the toggle lever type



for handling coils of steel up to 46 in. in diameter. Platform, 45 in. long, is fitted with an adjustable stop. Platform tilts 15 deg. from horizontal, and is operated from the tandem valve assembly that operates the elevating and lowering of the main platform. Lowered height from track to vertex of platform V is 13½ in. Elevated height 25½ in. Pump is motor-driven by a 3-hp. lowering hoist, and tilting hoist. It is controlled by a tandem four-way valve which is mounted on the truck column. The motor is controlled by a pushbutton and magnetic starter, and is equipped with cable reel and cable.



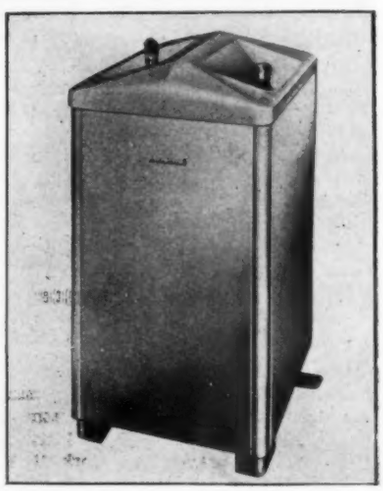
Long-Horn Spot Welder Has 50-kva. Capacity

Eisler Engineering Co., 745 S. 13th St., Newark, N. J., has developed a long-horn spot welder for deep sheet metal work. On this No. 250 AA machine both upper and lower horns can be lengthened or shortened. Horn adjustment makes it possible to weld light and heavy work and deep metal parts. Markings on the horn represent kva. ratings. Model illustrated is a 25–50 kva. air-operated welder. Cooling water goes through entire horn.

G.E. Industrial Water Cooler Is Entirely Self-Contained

General Electric Co., Bloomfield, N. J., has developed a high-capacity double-bubbler water cooler especially for use in heavy manufacturing plants, steel mills, and other industrial locations where workmen require plenty of drinking water. Identified as the Type RM-05, this cooler is entirely self-contained in a sturdy, rust-resistant, all-steel welded cabinet. Top is of stainless steel, drawn in one piece, with integral drain bowls to eliminate splashing.

Large reserve capacity to meet peak loads is provided by a 10-gal. stainless steel storage tank, and by an oversized compressor motor (¾ hp.) which is only 87 per cent loaded. Cooling chamber is refrigerated by a helically wound coil of silver-filled copper tubing. Cooling unit is insulated with



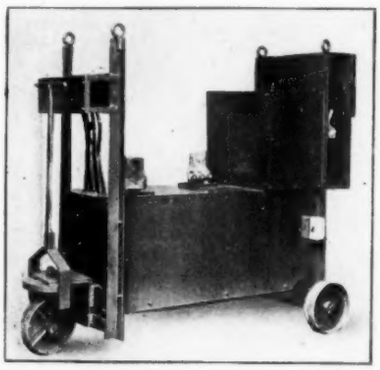
granulated cork, sealed in steel for protection against condensation.

Other features include an automatic stream regulator, a heat interchanger which improves performance, automatic temperature control with a high-pressure cutout, and a "Thermotector" to protect the compressor motor.

To maintain efficient operation in hot working areas the condenser is cooled by water instead of air. In addition, motor and compressor heat is removed by a special finned water coil, over which air is circulated by a four-blade fan. For operation in shipyards or other unheated space "freeze-proof" accessories are available.

Hysteresis Heating System Used in Field or Shop

The Smith-Dolan induction hysteresis preheating-welding-normalizing system, as developed by Electric Arc Cutting & Welding Co., 152-156 Jelliff Ave., Newark, N. J., is suitable for field work on pipe and special pressure vessel connections, and for similar work in the shop. Illustrated is a 90-



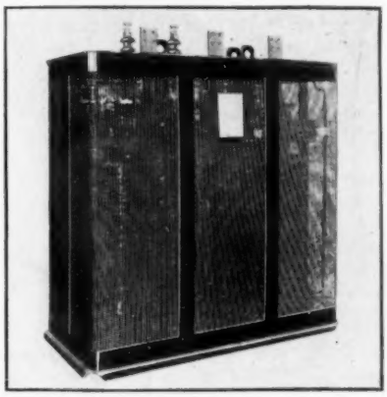
kw. preheating-welding-normalizing shop machine for vessels which require more accurate control than obtainable with furnace, gas or oil heating.

Special vessels of alloy steels requiring accurate heating control are conveniently handled by this system. Those with many connections or requiring too many trips into or out of the furnace are also said to be more economically treated in this manner.

Safety Outstanding Feature Of Air-Cooled Transformer

An air-cooled transformer claimed to provide a higher factor of operating safety than even before realized has been developed by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. With 60 cycle ratings ranging from 150 to 500 kva. for single phase and 150 to 1,000 kva. for three phase, at voltages of 13,200 and less, these Type ASL transformers are designed specifically for installations in buildings where safety is essential. Because no fire and explosion hazards exist with this design, substantial savings are effected by the elimination of protective vaults. Improved regulation and increased output are obtained because these transformers may be located near the load center, thus permitting short secondary cables.

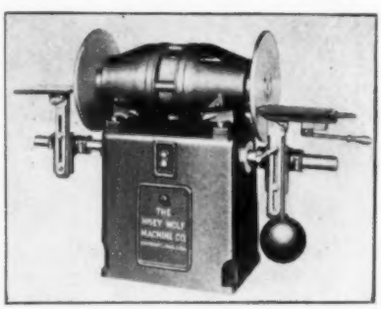
Housing is constructed of expanded metal finished in a black baked-on moisture-proof enamel which permits free flow of air from all sides and prevents accidental contact with live terminals. Primary and secondary coils



are separated by liberal spaces through which a stream of air constantly circulates. Windings are designed for 75 C. temperature rise under continuous full-load operation. Heat-resisting insulations are used throughout, allowing operation at higher temperatures than permissible with liquid-filled transformers.

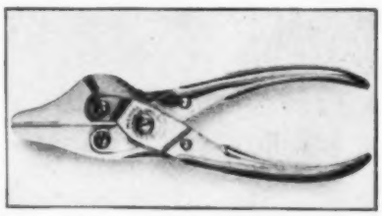
"Hisey" Disk Grinders Embody Improved Construction

Among the design improvements effected in the direct drive disk grinders made by Hisey-Wolf Machine Co., Cincinnati, Ohio, are extra heavy end bells with feet which carry the bear-



ing directly behind the disk. Bearing construction has also been improved, as has the method of lubrication. Oilers are of the constant level type with sight supply.

Motor is totally inclosed with a circulation of air passing through the motor, through the feet of the end bells into the pedestal, and back through the motor again. Machine, which is made in sizes from 3 to 10 hp., can be supplied with guards having exhaust connections. Combination machines can also be furnished with a disk on one end and a grinding wheel or buffing extension on the other.



Improved "Bernard" Pliers Have Larger Jaw Openings

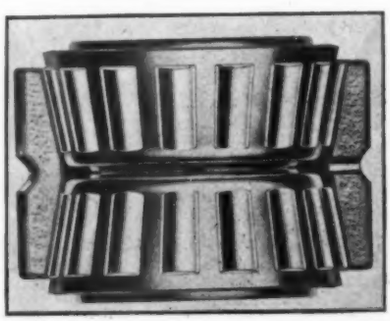
The improved No. 402 6-in. "Bernard" pliers offered by William Schollhorn Co., 414 Chapel St., New Haven, Conn., have a 25 per cent greater jaw opening and longer tapering jaws which make possible their use in smaller spaces. Similar to former parallel-action pliers, these tools retain such features as an open throat through which wire may be fed, compound leverage for increased power, and outside cutting jaws.

Modified Timken Bearing Suitable for Sheave Use

Timken Roller Bearing Co., Canton, Ohio, has modified its standard Type NA non-adjustable roller bearing to make it especially adaptable as a sheave bearing. Made up of a double row outer race and two single row inner races, this bearing has all parts ground to established precision limits.

Front cone faces are slotted and chamfered to provide passage for the lubricant into the bearing interior. This is of advantage in multiple-sheave blocks where the bearings must be lubricated through the stationary pin.

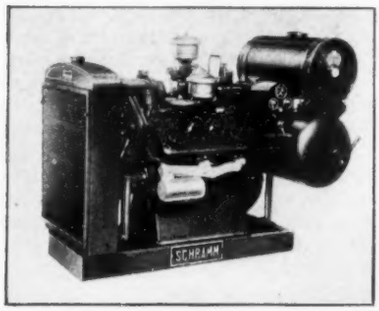
Sealing the bearing chamber has been greatly simplified by extending the length of the large cone rib and creating a surface concentric with the shaft and sheave bore on which a seal may run. These seals have the same outside diameter as the cup and are



pressed into the sheave bore, thus holding the bearing together during assembly. Bearing is designed to a minimum width and with an inside diameter large in relation to its outside diameter. Being an anti-friction thrust bearing as well as an anti-friction radial bearing, it rotates freely without axial float. Thus wear between sheaves and side plates is eliminated.

Schramm "Fordair" Compressor Built With Stationary Mounting

Replacing the Model No. 55, the Model No. 60 "Fordair" air compressor built by Schramm, Inc., West Chester, Pa., delivers about 8 per cent more air without any increase in dimensions



or weight. Available in stationary mountings, the engine and compressor are built into one V-block for compactness and better performance.

Units are complete with a built-in cooling system, water pumps being supplied to insure positive temperature control. They have complete electric starting systems, including battery, starter controls, starting motor, and battery generator.

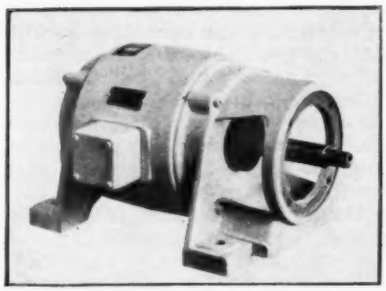
With these self-contained compressors, air can be had at a moment's notice and without installation foundations. They are available with fuel and air tanks mounted or without these accessories for the shop with an air system already installed.

For the large shops these units are said to make ideal boosters to supply the little extra air sometimes needed. Other large shops find it economical to have several of these units scattered about the shop with an air system already installed. For those having natural or manufactured gas these compressors can be adapted to operate on gas rather than gasoline.

Sterling Pump Motor Built for Easy Mounting

Sterling Electric Motors, Inc., Telegraph Rd. & Atlantic Blvd., Los Angeles, Calif., has developed a line of standard dimension motors especially for easy mounting of centrifugal and similar pumps.

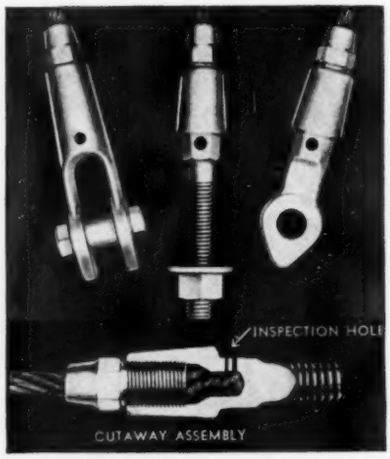
These ball-bearing motors have



ratings from ½ to 40 hp. for operation on three phase at 2-, 4- and 6-pole speeds. Extended shafts and machined fits for the pump mounting are all standard and the same dimensions throughout the entire range of ratings. A large Neoprene washer on the shaft between the pump packing and motor bearing, in combination with a trough cast around the bearing, makes it practically impossible for any of the material pumped to find its way into the motor bearing. The projecting shaft is covered with a special hard stainless steel tube which is ground and polished at the time the shaft is made.

Improved Wire Rope Connector Prevents Cable Crystallization

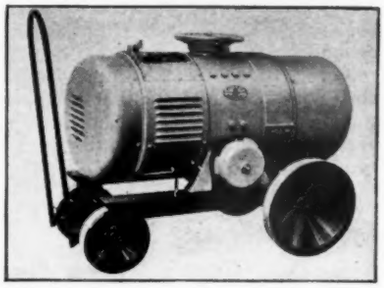
Improved "Electroline-Fiege" connectors offered by Electroline Co., 4054 S. LaSalle St., Chicago, Ill., are said to damp line vibration and grip the cable with a graduated compression, preventing crystallization at the point of connection and thus promoting longer rope life. Connectors con-



sist of three simple units: a sleeve which fits over the end of the wire rope, a tapered plug which is inserted to separate and hold the strands of wire in the sleeve, and a covering socket which securely locks the cable. Installation is made with ordinary mechanics tools. These connectors are available in black, hot galvanized and cadmium plated steel, and in bronze, stainless steel and monel metal for rope sizes under ½ in.

Dual Voltage Switch Made for Arc Welders

Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York, N. Y., has developed a dual voltage switch for installation on arc welding machines when they must be used on either of

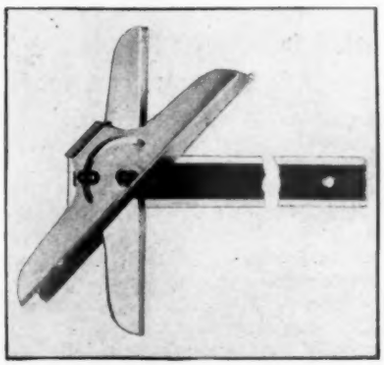


two line voltages at different times. This device, known as the Type CH switch, can be used on any motor employing alternating current, provided the motor and starter are reconnectable for two voltages.

With this switch, the change from one voltage to another can be made in less than one minute. Raised figures indicate the line voltage for which the switch is set. Unit has two main parts—a base mounted directly on the machine, and a removable top cover. This cover can be set on the base in two positions, one for each voltage.

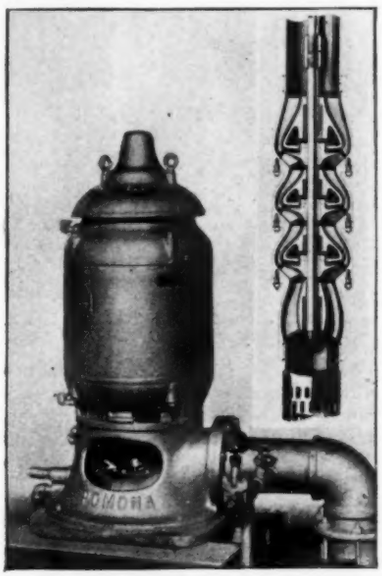
Stainless Steel T-Square Has Pivoted "Alumilite" Head

Transparent edges and pivoted "Alumilite" metal heads are outstanding features of the No. 30 stainless steel T-square offered by Turner Devices, Inc., 1212 Mississippi Ave., St. Louis, Mo. These T-squares embody the permanent accuracy of metal, as they are non-warpable and are not affected by atmospheric changes. Double channel construction insures rigidity. Narrow blade covers a minimum of drawing, and transparent edges are secured by dovetail edges instead of cement. Blade glides on two hard rounded surfaces that are claimed not to soil work nor collect dust.



Vertical Turbine Pump Redesigned for Economy

Pomona Pump Co., 660 E. Commercial St., Pomona, Calif., has completely redesigned its line of 6-in. medium capacity vertical turbine pumps to increase efficiency and performance. As



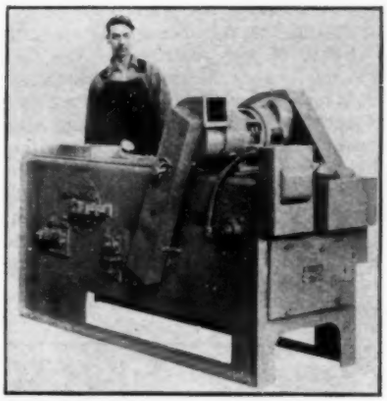
a result of newly designed impellers, only a 7½-hp. motor is required as against a 10-hp. motor for the same capacity with the older model. The number of stages has been reduced one-fourth and the initial cost is lowered 20 per cent.

Other advantages of these pumps include water lubrication, with no stuffing box below ground level; a specially designed semi-open impeller which can be adjusted from the surface for wear; and non-sandlocking and non-gaslocking characteristics. Constructed of high quality bronze, the impellers operate in cone-shaped seats in the pump bowls. Impeller vane curvature is said to insure maximum lifting capacity without overloading the motor regardless of changes in water level.

Stearns Magnetic Separator Uses Alternating Current

An unusual type of magnetic separator which utilizes alternating current for energizing the magnetic field has been developed by Stearns Magnetic Mfg. Co., Milwaukee, Wis., especially for separating finely ground powdered metal which may be contaminated by impurities such as oxide, scale, charcoal, silica or other small particles. Identified as the Type AM, this separator is claimed to be unusually effective since the material affected by the magnet receives 120 pulsations per second of constant agitation.

Material is spread uniformly by an adjustable vibrating feeder which pro-

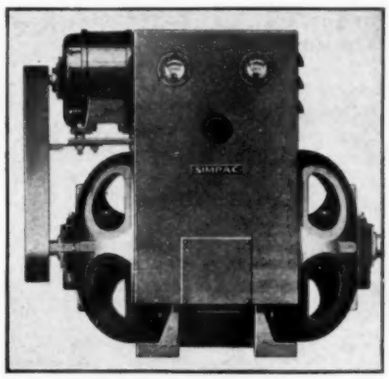


vides even distribution on the belt, where it is picked up by the magnet and carried along the underside of the separating belt. The high pulsating effect of the magnet frees the nonmagnetic impurities, allowing them to drop out. Under ordinary conditions three products can be produced—tails, middlings, and concentrates.

While the separator is fully inclosed in a structural steel frame practically dust-tight, provision is made for removable panels by which the material can be inspected while the separator is in operation. Bearings requiring oiling and other attention are mounted on the outside for ready accessibility. An exhaust fan is directly attached to remove dust from the material while in process.

Integral Exciter and Control Provided in a.c. Power Unit

A completely self-contained a.c. generating unit which regulates, controls, and meters its output has been an-



nounced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Called the "Simpac" power unit, it combines a standard open-type a.c. generator, a d.c. exciter, exciter field rheostat, voltmeter, ammeter, and optional voltage regulator in one integral unit. Designed especially for special requirements in industrial plants, it may be either engine or electric motor driven, direct or belt connected.

Construction is simple, yet rigid and strong. Exciter is mounted on a fabricated steel shelf above the generator and is driven off the generator shaft extension by a V-belt. Control, regulator, and meters are enclosed in a sheet steel cabinet fastened to one side of the generator frame. Voltage is adjusted manually by the exciter field rheostat, the voltmeter being in plain sight. Generator has an inherent voltage regulation of 10 per cent at 0.8 power factor. Ratings from 3.75 to 187 kva. are available at voltages of 120/128, 240 or 480, with operating speeds from 600 to 1,800 r.p.m. Units above 187 and up to 312 kva. may be obtained with separately mounted controls. All come wired and assembled ready for installation.

Die Cast Micro Switch Has Roller Type Plunger

Micro Switch Corp., Freeport, Ill., has made available a die cast micro switch with a roller-type plunger having a brass bushing which accepts the roller either longitudinally or crosswise.

Long life and precision performance from this type of actuator are assured by accurate concentricity of the hard-

ened and ground roller, which is carried on an oilless bearing. Adjustment for actuation by cam or slide in either of the two positions is quickly made by removal of the bearing screw. Die cast housing is available in either zinc or aluminum.

Switching element is the basic micro switch, a small single-pole snap-action switch having a rating of 1,200 watts up to 600 volts a.c. It may be furnished with normally closed, normally open, or double throw contacts.

Improved Micrometer Adjustment Permits Accurate Relay Setting

An improved micrometer adjusting knob and indicator incorporated in the latest types of automatic reset timers and time delay relays offered

by R. W. Cramer Co., Centerbrook, Conn., permits accurate adjustment of timer settings. Device is said to be simple, neat, and exceptionally rugged.

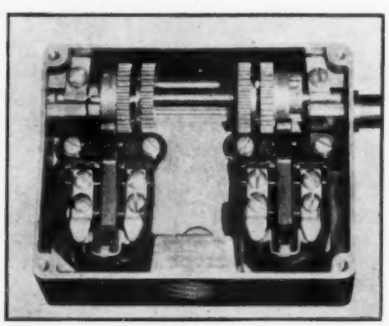
A knurled knob drives a worm gear which slowly moves a pointer around the dial. Since the pointer is brought to a fine edge which travels across an

easily read scale, accurate settings can be achieved with little effort. Instruments can be reset to virtually identical values with slight effort, and tiny changes in adjustment of the time interval are possible by a small twist of the knob.

Geared-Type Limit Switch Operates From Rotating Shaft

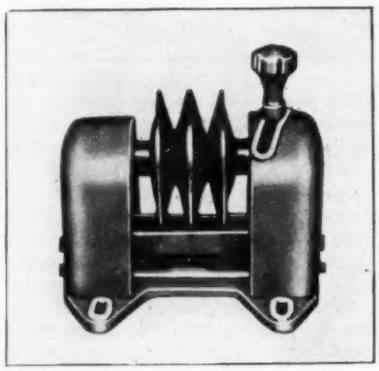
A small geared-type limit switch developed by General Electric Co., Schenectady, N. Y., has been designed for application on motor-driven devices where it is necessary to limit the rotation of the motor shaft or some rotating shaft member on the driven machine, one of the most important applications being on certain types of machine tools.

In use, the switch shaft (usually



direct-connected to an electric motor) serves as a driving gear, turning the pinion shaft. This shaft engages driving gears which move along the drive screw toward one of the operating gears at either end. At the end of travel in either direction, a pin on the traveling gear engages a pin on the operating gear. This causes the operating gear, cam, and safety pin, which are a unit, to rotate and move the switch contact arm to a high part of the cam, operating the contacts. These contacts are designed for 125-volt 4-amp. a.c. operation and 125-volt 1-amp. d.c. service.

Some of the features of the new switch are double-break, fine silver contacts which clean themselves with a rocking motion, and a mechanism easily adjusted to operate contact between a minimum of ½ turn of the driving shaft to a maximum of 120 turns, an over-travel of 3½ turns being provided to prevent accidental damage to switch mechanism. Case measures only $4\frac{1}{16} \times 3\frac{1}{2} \times 1\frac{29}{32}$ in.



"All-Speed" Transmission Suitable for Machine Tools

A V-belt variable speed transmission, known as the "All Speed," is offered by Standard Transmission Equipment Co., Suite 330, 416 W. 8th St., Los Angeles, Calif. This speed selector operates on the variable pulley principle, consisting of two interlocking pulleys mounted on a common shaft. The variable speed spindle can be pivoted laterally between the motor and the driven machine to provide new running diameters on the interlocking pulleys. Speed selected is maintained by a lock nut on the control quadrant, and the oblique slot automatically guides the spindle at all times to insure proper alignment.

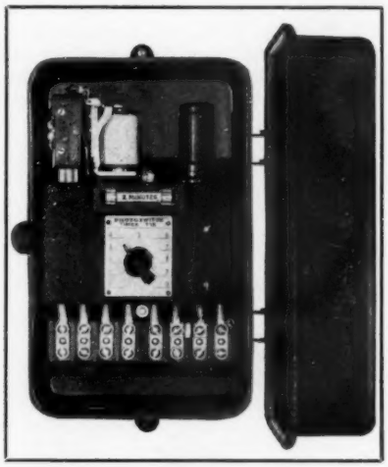
Special impregnated bronze bearings are used. The unit is made in three sizes for ⅝-in., A and B belts. It is available in speed ranges up to 12 to 1.

Short Interval Timer Built for Accuracy

The Type T 15 electronic timer developed by Photoswitch, Inc., 21 Chestnut St., Cambridge, Mass., is said to be extremely accurate over ranges from 1/20th of a second to two minutes. Control is accomplished through a specially designed snap-action relay of 1,000 watts capacity, giving an accuracy hitherto unapproached in simple and rugged timers.

Equipment is flexible with reference to actuating control, permitting both momentary pushbutton and sustaining contact control. It is universal for six timing ranges represented by timing valves snapped into a readily accessible clip.

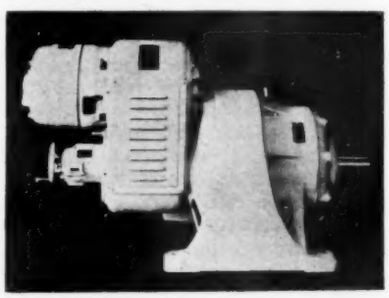
Timer has been built with an accuracy permitting complete inter-



changeability of equipment. Thus machine process calibrations for one timer apply to all timers. Unit has been designed throughout for life guaranteed to match that of any machine to which it is applied.

"Varidrive-Syncrogear" Units Feature Greater Compactness

Units which are more compact, smaller and lighter are achieved through the elimination of a sub-base on the Type VEV-GD and VEV-GT "Varidrive" gearmotor offered by U.S. Electrical



Motors, Inc., 80 34th St., Brooklyn, N. Y. These motors have double reduction and triple reduction gears for low-speed drives.

Further modification of the former design is the mounting of the "Varidrive" case at any angle with respect to the gear case. Thus if the unit is to be mounted where headroom is low, the case may be laid over on its side to provide clearance. Pyramidal gear pedestal provides both a rigid mounting for the "Varidrive" case and a sturdy "Syncrogear" motor capable of withstanding the heavy torsional stresses resulting from heavy loads at low speed.

Tooth surfaces of all gears are hardened to 55–65 Scleroscope, providing maximum life. Pinion cores are ex-

The productive capacity of a milling machine depends more upon its rigidity than on any one other factor. Rigidity originates in the column — the backbone of the machine. Examine the column of a Milwaukee Milling Machine and you will see that it has been carefully engineered for the proper distribution of metal. An inside horizontal wall divides it into a double box section; the cross mounting of the motor permits a solid rear wall, which together with the solid front face, assures an unusually rigid structure.

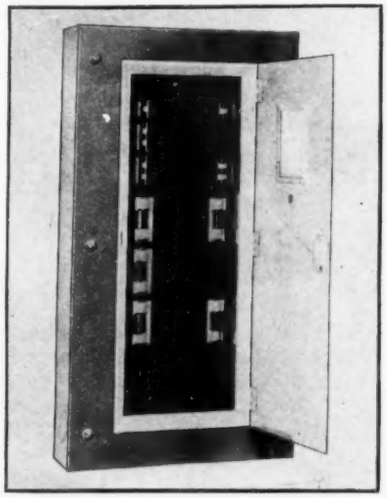
KEARNEY & TRECKER CORPORATION • Milwaukee, Wis., U. S. A.

MILWAUKEE MILLING MACHINES

tremely tough and of proper ductility to assure maximum fatigue resistance necessary to withstand severe shock stresses.

Breaker Panel Board Made Available by Square D

Square D Co., Detroit, Mich., has developed a Type MH "Multi-breakeR" distribution panel board to provide circuit breaker protection for power and light distribution circuits of 100 amp., 230 volt capacity. Individual



breakers are furnished in 15 to 100 amp. capacity, of 1-, 2- or 3-pole, for 115- and 230-volt, single phase and three phase a.c. systems.

The panels are completely dead front—no live parts are exposed even when restoring service after an overload. Simple construction insures long life, and compactness of the panels permits them to be easily installed on rewiring jobs.

Morse Drum Cradle Truck Features Ease of Loading

Ease of loading is one of the principal features of the No. 45 drum cradle truck announced by Morse Mfg. Co., 304 W. Jefferson St., Syracuse, N. Y. Construction of this truck provides a substantial wheelbase well under the center of gravity of the drum. Two wheels are mounted on a straight axle and the other two are mounted on casters to provide maximum tread width. Shape of the frame is such that it may be loaded and unloaded simply by tipping.

"Ideal" Storage Battery Developed for Flashlight

A rechargeable flashlight battery similar in principle to the automobile storage battery has been developed by Ideal Commutator Dresser Co., 1057 Park Ave., Sycamore, Ill. Although small enough to fit all popular two-cell flashlights, this battery is said to give dependable long life and to be economical in heavy duty service.

The battery permits considerable savings for large users of flashlights, as it can be charged repeatedly. In heavy use one discharge is equal to a pair of ordinary dry cells. The rechargeable feature makes it convenient to use only while the light is

bright and to charge again when the light gets dim.

A specially designed chamber and vent and semi-fixation of the electrolyte make the battery spill-proof. Plates are over ¼ in. thick, and are connected to terminals by reinforced electrodes to withstand rough handling. Case is of transparent Lucite.

A small charger consisting of a transformer and rectifier plugs into any 110-volt 60-cycle socket. Recommended charging time is 12 hours.

Three-Wire Drum Control Built for Machine Tools

Cutler-Hammer, Inc., 205 N. 12th St., Milwaukee, Wis., has developed a drum type master switch providing three-wire control, which is said to be particularly adaptable to machine tools. This type of switch provides the function equivalent to two or three button heavy duty pushbutton stations, and is superior for use when

an operating lever is preferred to button.

Unit can be furnished for surface, cavity or panel mounting and with either standard or pistol-grip handle. By removing a stop post, the drum may be converted from non-reversing to reversing. Nameplate is marked on one side for reversing service and on the other side for non-reversing, thus making it suitable for either application. Rating of the switch is for pilot circuits up to 600 volts a.c. and d.c.

Hook-on Volt-Ammeter Speeds up Test Work

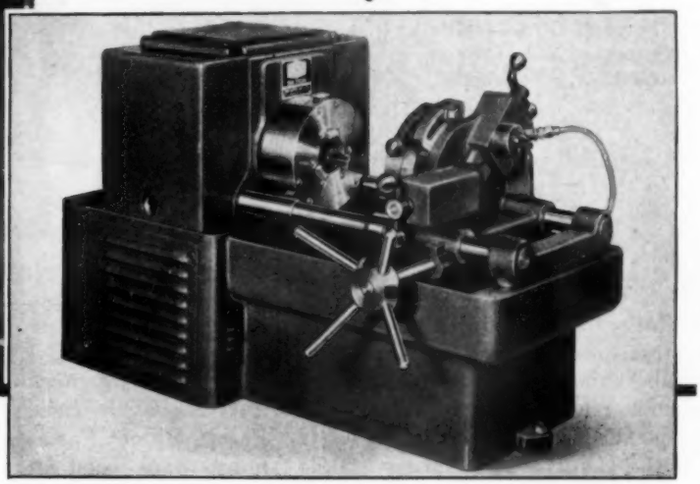
The Type AK-1 portable hook-on volt-ammeter for measuring alternating current and voltage has been introduced by General Electric Co., Schenectady, N. Y. With it, alternating current can be read instantaneously on both insulated and non-insulated conductors simply by hooking the instrument around the line. For voltage readings, it is necessary only to connect two leads furnished with the instrument and then flip the thumb-manipulated selector switch to the desired voltage position on the scale.

Designed for use on conductors of

The New "TOM THUMB" PIPE THREADER

OSTER

Study these modern features



1. MODERN DESIGN—all BALL BEARING construction.
2. COMPLETE RANGE—1/2" to 2"—up to 8" with drive shaft.
3. DIE-HEAD—quick-opening, fully adjustable—heavily built.
4. DIES—High Speed Steel.
5. CUT-OFF DEVICE—High Speed Steel, lathe type tool with V Block steady rest.
6. REAMING AND CHAMFERING DEVICE—High Speed Steel forming tool does both operations at the same time.
7. TWO CHUCKS—front chuck, bar operated, three jaw, gripping—rear chuck, three jaw, wheel operated, centering. Both chucks, quick acting.
8. MOTOR—Black & Decker, 1/2 H.P. universal, reversible, variable speed—light socket operation.
9. WORM GEAR DRIVE—hardened and ground, steel worm with bronze worm gear.

Write Us for Details and the Unusually Low Price

THE OSTER MANUFACTURING CO.

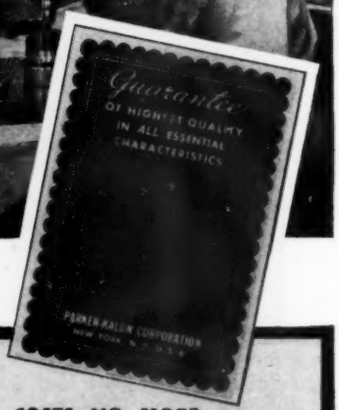
2049 EAST 61st STREET

CLEVELAND • OHIO • U. S. A.

UNEQUALLED CHECK-UPS

eliminate the "Doubtful Few"

Some of the scientific check-ups in the 16-Point Quality-Control routine.



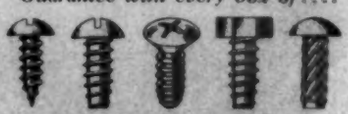
. . . when Parker-Kalon's Quality-Control Laboratory backs your fastening devices

You get an unequalled protection against time-wasting, cost-boosting "duds" among your fastening devices when you specify Parker-Kalon! For, in Parker-Kalon's plant, an unusual Quality-Control Laboratory stands guard over all production, to eliminate the "doubtful few" screws that slow-up assembly work and produce unsatisfactory fastenings.

Without counterpart in the industry, this scientific Laboratory sets standards of quality that could never be maintained without rigid quality-control of every production step from chemical analysis of the metal to micrometric check-up of finished dimensions. It insures that every Parker-Kalon Fastening Device is more than "good enough" in both accuracy and strength.

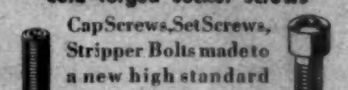
Take no chances in your assembly jobs . . . buy Hardened Self-tapping Screws, Socket Screws or other fastening devices that are made in the screw industry's most modern plant. Parker-Kalon Corporation, 194-196 Varick Street, New York.

COSTS NO MORE *to get this Parker-Kalon Quality-Control Guarantee with every box of . . . .*



Hardened Self-tapping Screws
Types, sizes, head-styles for every assembly of metal or plastics

Cold-forged Socket Screws
Cap Screws, Set Screws, Stripper Bolts made to a new high standard of quality



Wing Nuts-Cap Nuts-Thumb Screws
Cold-forged . . Neater, Stronger

SOLD ONLY THROUGH RECOGNIZED DISTRIBUTORS

Quality-Controlled **PARKER-KALON Fastening Devices**

2-in. maximum diameter, this instrument is small enough to get into tight places, light enough to be hung from a lineman's belt, and sufficiently accurate for a great variety of measuring jobs. Weighing only 3½ lb., it is designed for easy, one-hand operation. Four current ranges, 0–15/60/150/600 amp., and two voltage ranges, 0–150/600 volts are available at the setting of a convenient six-position snap switch.

Goodrich Air Hose Stands Excessive Hot Oil Service

Recommended for use where excessive hot oil conditions are encountered, an air hose made with a synthetic tube and rubber cover has been developed by B. F. Goodrich Co., Akron, Ohio. Known as the Type 54, this hose is said to give two to three times longer service when exposed to the same conditions as a tube made of natural rubber. It is built with a smooth, abrasion-resistant cover.

"Electromatic" Spring Wire Produced by New Process

"Electromatic" oil tempered wire for special mechanical springs is now being produced by an electric direct resistance method by Jones & Laughlin Steel Corp., Pittsburgh, Pa. In contrast to the conventional methods of heating wire to quenching temperatures, either in furnaces or by immersion in molten baths, this process consists of passing sufficient electric current through the wire to heat it. Electrical resistance in the wire increases its temperature uniformly, with the full cross-section heated simultaneously to the desired quenching temperature.

The new equipment handles a wide variety of gages, and is so constructed that wire fed from reels passes first through tension rollers, then through a molten electrical contact. From there, the wire passes through a second molten contact, completing the electric circuit. These contacts are held at a constant temperature, the second also serving as a primary quenching bath from which the wire immediately passes to an oil bath for the final quench. This double-phase quenching provides a gradual reduction in wire temperature, preventing the steel from being shocked. Continuing from the final quench through a molten tempering bath, the wire is reheated to give it the desired physical properties and fatigue values.

Fundamental advantage of the process is the exactness with which all factors affecting the ultimate quality of the wire are readily controlled. The constant flow of current of controlled voltage and amperage, together with the closely regulated speed of the machine, governs heating to within precise limits. In addition, thermocouples in all contact, quench, and temper baths provide automatic

No "doubtful" screws for this transformer case!

They Specify QUALITY-CONTROLLED PARKER-KALON SOCKET SCREWS

Careful buyers like Allis-Chalmers take no chances on "doubtful" socket screws in their equipment. They specify Parker-Kalon and escape the "doubtful few". . . those few imperfect screws in a box that might delay assembly work or fail in service.

Parker-Kalon Socket Screws are produced under a rigid control routine made possible only by Parker-Kalon's unique Quality-Control Laboratory. Sixteen exacting tests and inspections insure that every screw in a box is "better than good enough."

Specify Parker-Kalon next time . . . they cost no more. Look for the Quality-Control Guarantee that vouches for their extra quality. For free samples and distributor's name, write: Parker-Kalon Corporation, 202 Varick Street, New York.

Quality-Controlled

16-point test and inspection routine covers: Chemical Analysis; Tensile and Torsional Strength; Ductility; Shock Resistance under Tension and Shear; Hardness; Head diameter, height and concentricity; Socket shape, size, depth and centricality; Class 3 Fit Threads; Clean-starting Threads.

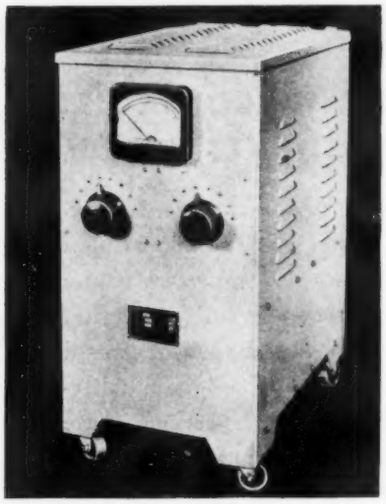
PARKER-KALON
COLD-FORGED
Socket Screws

temperature control over these units. The resulting combination of accurate time and temperature regulation makes possible accurate control of the heating and quenching cycle.

As length of heating time and control of quenching temperatures have a direct effect on grain structure, this method makes it possible to control and reproduce desired grain sizes with great accuracy. Double-phase quenching has been found considerably to improve physical characteristics, making possible close control of tensile strength, elastic limit, elongation, and Rockwell values. Also, as all the heat is within the wire itself, decarburization and scaling are controlled within narrow limits.

Portable Testing Rectifier Provides Seven Voltages

The Model SP-20 rectifier made by Mellaphone Corp., Rochester, N. Y., designed especially to provide direct current from an alternating current source for testing purposes, provides output voltages of 32, 110, 115, 120, 210, 225 and 240 volts. Voltage, which is adjusted by knobs on the front



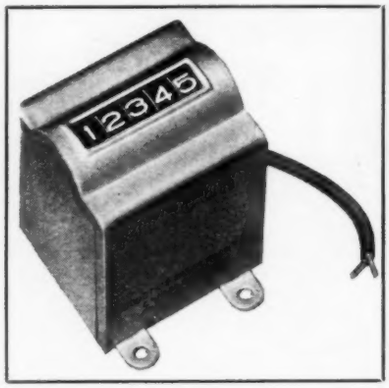
panel, is indicated on a meter mounted in the panel.

Current capacity of the rectifier is 30 amp. at 32 volts d.c., and 20 amp. at all other voltages. Two mercury vapor tubes are used to obtain full-wave rectification of the single-phase a.c. Output voltage is claimed to remain practically constant from no load to 25 per cent overload. Rectifier contains no moving parts.

Compact Electric Counter Made by Production Instrument

A small electric counter which has been developed especially to meet the demand for a dependable low-cost magnetic counter has been announced by Production Instrument Co., 702-06 W. Jackson Blvd., Chicago, Ill. Known as the "Mercury" counter, this device consumes only 2 watts, insuring long life to switch contact points and making the instrument particularly suited for electric eye operation. The device will operate at up to 600 counts per minute.

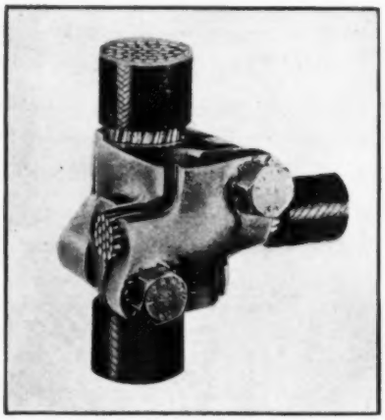
Tamper-proof construction, non-reset feature, totally inclosed assembly, and convenient mounting make the counter suitable for built-in applications. Case and frame are of



cadmium-finished steel with an unbreakable plastic window. Five number wheels record to 99,999 and repeat. Counters are available for 60-cycle a.c. for voltages up to 230, and for d.c. for voltages up to 115.

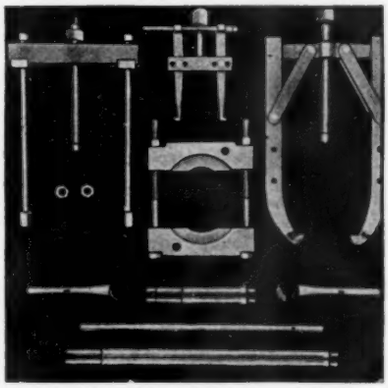
Burndy Electrical Connector Has Several Distinct Uses

The type QPX "Versitap" offered by Burndy Engineering Co., 459 E. 133rd St., New York, N. Y., is a connector that may be used as a parallel tap, a T-connector, a cross connector and as an end-to-end connector. It will



clamp a large range and combination of cable sizes in either the main or branch connection grooves, is installed with an ordinary wrench and is easily taped. The connector is made of high strength materials for those parts which carry mechanical stress and of high electrical conductivity materials for those parts which carry current. Ten sizes make the device especially suitable for industrial wiring.

Correction—Owatonna Tool

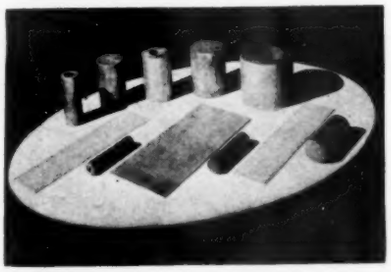


When mounted on a 4x4-ft. board, the industrial puller set made by Owatonna Tool Co., 353 Cedar St., Owatonna, Minn., looks like this—not as shown on page 596 of Vol. 84, where the cut was inverted

NEW MATERIALS

"Oilite" Bearing Metal Available in Bar Stock

The Amplex Div. of Chrysler Corp., 6500 Harper Ave., Detroit, Mich., has made available "Oilite" self-lubricating bearing material in cored and solid bar stock as well as plate and



sheet stock. In this form it serves a definite purpose in industry in that it allows for the installation of an "Oilite" bearing in emergencies.

Cored bars are 6½ in. long and are available in various inside and outside diameters. Sufficient material is left on both these surfaces to allow for suitable machining, which is done very easily following usual machining procedure. This is also true of the solid bars.

These new stock sizes are of the same "Oilite" as has been available in sheet and plate form previously. This material is an oil cushion bronze thoroughly impregnated with a good grade of lubricant to the extent of 35 per cent by volume. Since the material is porous, the self-contained oil provides a high factor of safety and assures long life and smooth operation. Pore structure of the bronze is not destroyed or harmed by machining.

Hammered Metal Effects Produced by New Finish

Finishes resembling hammered silver, copper, bronze, and other ornamental metals can be applied to products made of any kind of metal and plastics by "Hammertone" finish, developed by Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J.

In finishing a surface, a base coat of the desired color is first sprayed on. This is followed immediately by a spatter coat of "Hammertone" liquid, which produces the hammered pattern in the base coat. The product is then baked at medium heat for an hour, which produces a lustrous metallic finish that is tough and durable. By using a special form of spray gun perfected by Maas & Waldstein for the spatter coat, even an inexperienced sprayer can produce any desired hammered pattern and maintain it uniformly.

"Hammertone" is claimed to be an excellent finish for metal novelties, heating units, air-conditioning equipment, metal cabinets and furniture, plastic radio cases, and other similar products. Speed and ease with which it can be applied adapt it for continuous production methods.

TRADE PUBLICATIONS

ACCIDENTS National Safety Council, Chicago, Ill., has issued its annual statistical report for 1939 on accidents in the metal products industry.

BENDING MACHINES American Pipe Bending Machine Co., Boston, Mass., offers a 3-page folder which gives a brief description of three sizes of motor-power operated machines with bending equipment.

BRAKES Stearns Magnetic Mfg. Co., Milwaukee, Wis., has issued a 12-page bulletin No. 604, which provides a complete description, specifications, formulas and installation views on the subject of magnetic disc brakes.

BURNISHING MATERIALS H. Leroy Beaver, Lansdale, Pa., offers four-two-page leaflets which provide information regarding burnishing materials.

CONVEYORS Metzgar Co., Grand Rapids, Mich., offers a three-page folder which describes the application of wheeled conveying systems.

FAN WHEELS A new 80-page catalog which illustrates a complete line of fan wheels, and which provides many performance charts and tables showing the capacities of the different size fans, is being circulated by Advance Aluminum Castings Corp., Chicago, Ill.

MILLING, HOBBING MACHINES Lees-Bradner Co., Cleveland, has published a 16-page booklet which illustrates and describes various milling, hobbing and grinding machines.

OIL COOLERS Catalog No. 31 circulated by Condenser Service & Engineering Co., Hoboken, N. J., describes the uses and design of lubricating oil coolers.

PLUGS Pile-National Co., Chicago, Ill., offers Bulletin No. 114-2 which lists prices and sizes of plugs and receptacles.

PRE-FINISHED METALS American Nickeloid Co., Peru, Ill., has issued a series of five small folders which indicate how the use of pre-finished metals will reduce manufacturing costs.

PRESSES Clering Machine Corp., Chicago, Ill., presents a brochure which describes applications, operating advantages, design and construction, capacities and size of hydraulic power press equipment.

PULLERS Owatonna Tool Co., Owatonna, Minn., has published Bulletin No. G-3-40, which lists prices and provides operating details of Grip-O-Matic pullers.

SHELL HOLDERS Logansport Machine, Inc., Logansport, Ind., has issued a new bulletin which describes air and hydraulic operated shell holding equipment.

STARTERS Trumbull Electric Mfg. Co., Plainville, Conn., is distributing circular No. 322 which illustrates and explains the features of its entire line of magnetic starters.

STEEL Republic Steel Corp., Cleveland, Ohio, has released a 4-page folder which contains tabulated data of the analyses and properties of 13 of the most popular types of Enduro stainless steel.

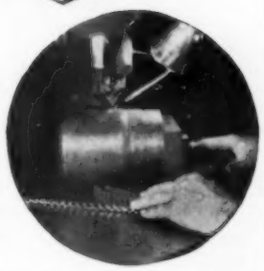
SWITCHBOARD INSTRUMENTS Catalog No. 43-205 circulated from Department 7-N-20, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., describes the construction and operating principles of rectangular case switchboard instruments.

VALVES Homestead Valve Mfg. Co., Coraopolis, Pa., offers a four-page pamphlet which describes and illustrates the construction and operation of valves.

WELDERS A 4-page illustrated leaflet No. 26-325 describing portable a.c. welders is issued by Dept. 7N20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

WELDERS A 4-page bulletin No. 51, circulated by Acme Electric Welder

DoALL RELEASES OTHER MACHINE TOOLS ON URGENT DEFENSE JOBS



Chrome Vanadium Steel Part for hydraulic press. Made by Burndy Engineering Co., New York.

Former Milling time..... 13 hours
The DoAll removed sections shown in 37 minutes, reducing the finish milling to..... 2 hours

DoAll Savings on Milling...11 hours

The DoAll offers important short cuts in stepping up production. A great time and energy saver in cutting out internal and external shapes from any metal up to 10" thick.

Eliminates long hours of tedious hand work in making special tools and dies and in turning out short runs of metal parts.

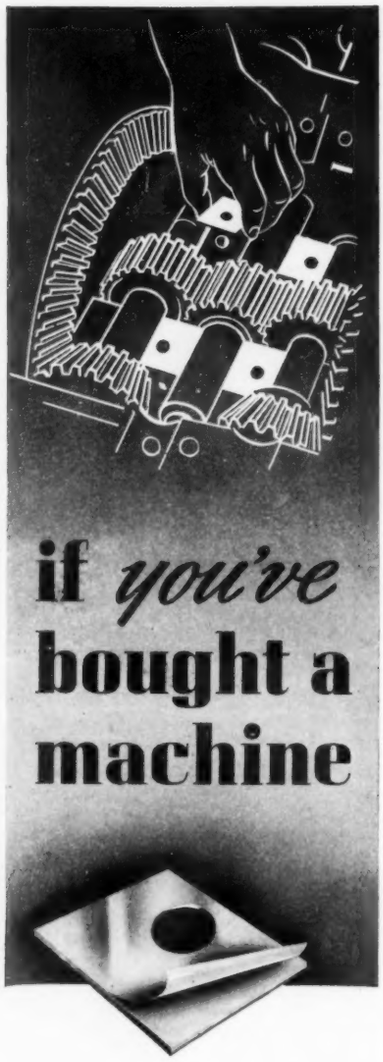
This rugged precision machine tool is creating a sensation in 30 countries—in metal working plants, machine shops, arsenals, airplane factories, ship yards, etc.

Let a factory trained man bring a DoAll to your plant and show you what it can save on your own work.

FREE—New Handbook on Contour Machining—158 pages of valuable metal working helps.

CONTINENTAL MACHINES, INC.
1310 S. Washington Ave., Minneapolis, Minn.

☐ Send data on the DoAll AM-10
☐ Send free Handbook
Name .....
Address .....



if *you've* bought a machine

—or intend to...

Probably Laminum shims are standard equipment on your new purchase. If not, when you service it use Laminum for quick adjustments of bearings and fitted mechanical parts. It pays! Simply *peel* off .002 or .003 inch brass laminations. For *precision* adjustment! • *Shims cut to your specifications . . . stock shim materials are sold by mill supply distributors.*

Laminated Shim Co., Inc.
50 Union St., Glenbrook, Conn.

Write for file-folder of shim application photos—with Laminum sample.

LAMINUM

THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

A-1170

Co., Huntington Park, Calif., describes the advantages of foot-operated spot welders.

WINCHES Stephens-Adamson Mfg. Co., Aurora, Ill., provides bulletin No. 340 which describes a complete line of hand and motor winches.

NEW BOOKS

LIGHTING AND AIR CONDITIONING—*Production Series Booklet No. 118, published by American Management Association, 330 W. 32nd St., New York, N. Y. $0.75.*

Containing many practical recommendations as to proper applications of lighting and air conditioning in the modern plant, this booklet contains articles by W. C. Brown, illuminating engineer, General Electric Company; A. E. Stacey, Jr., Buensod-Stacey Air Conditioning, Inc.; and William B. Henderson, Air Conditioning Manufacturers' Association. Much of the data is tabulated. Line drawings and photographs are used to illustrate many of the principal points brought out in the discussion.

•

BETTER FACTORY DESIGN—*Production Series Booklet No. 117, published by American Management Association, 330 W. 42nd St., New York, N. Y. $1.*

Containing sections by Raymond S. Perry, Ingersoll Milling Machine Co.; Albert Kahn, Albert Kahn, Inc.; H. K. Ferguson, The H. K. Ferguson Company; W. J. Austin, The Austin Company; L. J. Jordan, Industrial Rayon Corporation; R. D. Frick, Campana Corporation; and Stanley M. Brown, Hygrade Sylvania Corporation, this booklet entitled "Lowering Costs Through Better Factory Design" should be of interest to presidents of companies, general managers, and plant engineers, throughout industry. The authors collectively have a very wide experience in the design and maintenance of factory buildings and, from their experience, have incorporated in this booklet a number of valuable suggestions.

•

PRACTICAL MECHANICS AND STRENGTH OF MATERIALS. *Third Edition. By Charles Wilbur Leigh, B. S., professor emeritus of analytic mechanics, Armour Institute of Technology, and John Frederic Mangold, associate professor of mechanics, Armour Institute of Technology. 498 pages. McGraw-Hill Book Company, 330 West 42nd St., New York, N. Y. $3.00.*

This volume, as the title suggests, presents those principles of mechanics and strength of materials which the authors believe essential for the practical man. The aim throughout has been to develop the material as one continuous subject, rather than as two separate ones. Each chapter on strength of materials is preceded by those principles of mechanics necessary for its presentation.

The book is intended for night schools, vocational schools, colleges desiring a short course in mechanics, and for men engaged in practical construction work. It is not a course in design. So far as the mathematical requirements are concerned, the student who has a working knowledge of algebra, geometry and trigonometry will have no trouble in reading it.

Formulas for estimating strength of machine parts are included, and are illustrated by numerous problems. Both graphic and algebraic methods of solution are presented at the same time.

In the third edition a large amount of material has been added to the previous edition to enlarge the scope and effectiveness of the text. All lists of problems are new.

•

FIRE—*Published by Harold Joe Davis, 3927 E. Admiral Place, Tulsa, Okla. $0.25.*

This 14-page booklet discusses the cause, prevention and control of fire, which destroys more than $300,000,000 worth of property in the United States each year. The author points out that while fires occur under conditions that vary greatly, the basic cause of fire is the same. Fire can exist only if three elements are present: (1) something to burn, (2) a form of active energy or heat, and (3) the proper mixture of air. Without a combination of all three of these, a fire cannot exist.

An important part of this booklet is a discussion of the four classes of fires, and successful agents used for extinguishing each type.

•

SIMPLE BLUEPRINT READING WITH SPECIAL REFERENCE TO WELDING—*138 pages. Published by the Lincoln Electric Company, Cleveland, Ohio. 50 cents in the U.S.A., 75 cents elsewhere.*

In view of the need of training so many beginners for the various branches of the metal-working industry this little book should come in very handy. While primarily intended for the welder, the principles pointed out in it are of value to anyone concerned with mechanical construction.

A simple approach is used, starting with a picture of a simple welded object and showing how it can be presented as a perspective drawing, an isometric drawing and an orthographic projection. The various conventions commonly used in drafting, such as broken views, omitted parts, dotted lines, dimensions and methods of indicating type of weld are described. In short, the book affords a sound treatment of the fundamentals.